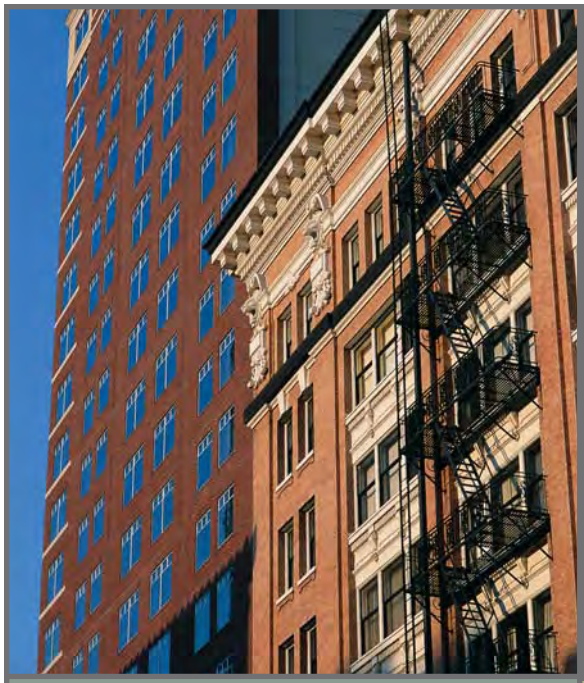

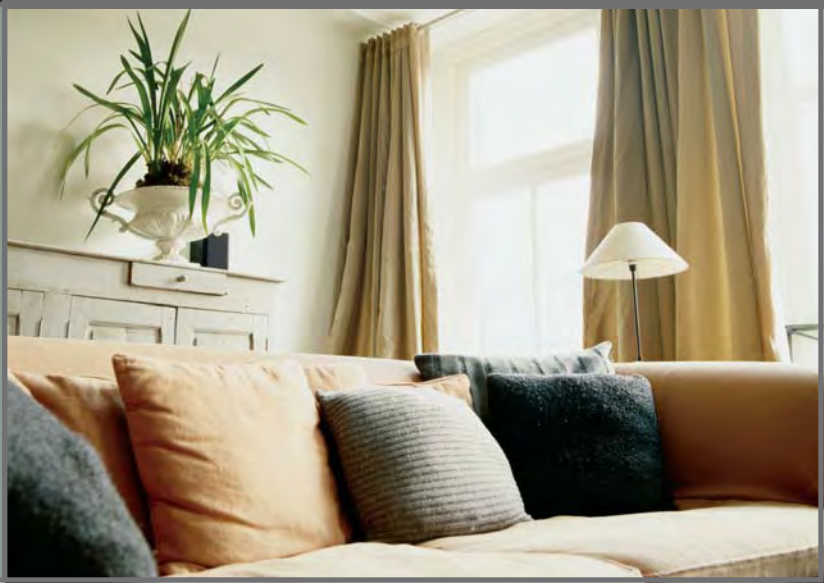

THE SMART SOLUTION FOR ENERGY EFFICIENCY

ENGINEERING DESIGN GUIDE: TRANQUILITY MODULAR (TRM) SERIES 0.75 TO 3 TON VERTICAL HI-RISE EARTHPURE® UNITS

CLIMATEMASTER®

WATER-SOURCE HEAT PUMP SYSTEMS

The Smart Choice for Energy Efficiency

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Revised: 07/26/06D

ClimateMaster Water-Source Heat Pumps
Tranquility Modular (TRM) Series
0.75 to 3 Ton Vertical Hi-Rise Units

COMMERCIAL HVAC

The ever-changing environment of commercial construction offers exciting breakthroughs in technology and materials, but it is not without some heartburn. Today, owners, architects, and contractors face many challenges in the design and construction of their projects. Challenges such as usable space, indoor air quality, energy efficiency, maintenance costs, building longevity, and the LEED® program all come to the forefront of the design process. When considering the solutions to these challenges, the type of HVAC system chosen directly affects each one.

USABLE SPACE

It has been said that the reason real estate grows in value is because no one is making any more. As cities continue to grow and spread out, the value of maximizing usable space becomes increasingly important. When selecting an HVAC system, you positively or negatively impact the usable space on a project. As an example, VAV (Variable Air Volume) systems utilize complicated ductwork systems along with extensive equipment rooms to deliver conditioned air into the building space. Additionally, VAV duct systems many times require more ceiling height which increases floor-to-floor space thus increasing building costs. By comparison, ClimateMaster Water-Source and Geothermal Heat Pump systems require little to no equipment room space and use a very simple, compact, and independent ductwork system.

INDOOR AIR QUALITY

As important as the actual temperature of a building space is, the quality of air within that space is equally important. The American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) has implemented Standard 62, which requires significantly higher amounts of fresh outdoor air for buildings. The challenge now becomes how to properly introduce, condition, and deliver this fresh air into the building space. Traditional options like two- and four-pipe Fan Coil systems must be up-sized significantly to handle the additional conditioning load. This means larger, more expensive units, larger, more expensive piping, and larger more expensive boilers and chillers. In comparison, ClimateMaster systems offer a variety of options that can actually lower the overall system size, introduce 100% outdoor air, and lower system usage cost.

ENERGY EFFICIENCY

Today's offices equipped with computers, copiers and other office tools can dramatically affect the heating and cooling load of a given space. When considering heating and cooling loads, rising energy costs demand an HVAC system that is efficient while building designs require a system that is also flexible. ClimateMaster has a solution for practically any application, and does so with some of most energy efficient HVAC systems available on the market today. In fact, all of ClimateMaster's products either meet or exceed the new federal mandated efficiency minimums.

MAINTENANCE COSTS

Complex systems such as two- and four-pipe fan coils and VAV systems require advanced maintenance and the trained personnel to perform it. Large equipment rooms filled with chillers, air handlers, or large-scale boilers require personnel for monitoring and maintenance, which consume building space and leasing profits. The effect to the bottom line becomes significant when considering the potential of a complete system failure along with costly parts and equipment replacement. However, Water-Source and Geothermal Heat Pumps require very little monitoring and maintenance - aside from routine filter changes. With factory installed DDC controls, the entire building can be accessed via any web-enabled computer for monitoring and set point control. No muss, no fuss, no worries.

BUILDING LONGEVITY

New innovations offer longer life expectancies for today's buildings. You should expect the same from the HVAC systems being placed inside these buildings. However, when it comes to longevity, not all systems are created equal. Complex chillers and air handling systems often have a large number of moving parts that will wear out over time. Water-Source and Geothermal Heat Pumps offer the advantage of very few moving parts. Fewer moving parts lower the occurrence of parts replacement and extend equipment life. This simplicity of design allows ClimateMaster systems to provide average life spans of 20 years or more. In fact, there are a number of ClimateMaster units that are still performing after 50 years - providing the continual comfort our customers have come to expect.

MANY CHOICES, ONE SOLUTION

When choosing a HVAC system for a project, there are four basic types from which to choose.

FAN COILS

Fan coil systems are comprised of water-to-air coil air handlers connected via a two- or four-pipe insulated water loop. Fan coils require complex chillers and boilers to provide water loop fluid in a particular temperature range (i.e. chilled water for cooling and hot water for heating). Two-pipe fan coils have a major disadvantage as control is substantially limited to whatever mode the system is currently set at (i.e. cooling or heating). A four-pipe version can be installed that requires both chilled and heated water to be available at the same time. Four-pipe systems also require twice the piping and twice the circulation equipment of a two-pipe system, which makes a four-pipe system one of the most expensive systems to install.

VARIABLE AIR VOLUME (VAV)

Variable Air Volume, or VAV, is one of the most common types of HVAC systems used in large commercial buildings today. A typical system is usually comprised of a large air handler, central ductwork system, and a relatively large equipment room. Conditioned air is distributed throughout the building via a central ductwork system and is regulated via dampers in each space. VAV systems typically have a higher first cost than Water-Source Heat Pumps, and may have similar operating costs, resulting in overall increased life cycle costs.

ROOFTOP

Rooftop systems are similar to VAV systems in that they use a central ductwork system to distribute conditioned air into the building space. However, instead of one central unit, the system is comprised of multiple units which can be tasked for different conditioning requirements. Rooftop systems usually require additional structural reenforcement as well as cranes or other lifting equipment to place the units. Control in a particular zone is limited to what the system is currently set to (i.e. cooling or heating). Rooftop installation costs are low to moderate, but operating costs are typically 50% higher than Water-Source Heat Pumps. Additionally, the systems are exposed to the elements and are subject to damage and vandalism.

WATER-SOURCE AND GEOTHERMAL HEAT PUMPS

Water-Source and Geothermal Heat Pump systems are comprised of individual packaged units that transfer heat via a single- or two-pipe water loop. Each unit can be used in either heating or cooling mode year-round and loop temperature is maintained via a boiler/tower combination or earth-coupled loop. Each zone has complete control of its heating/cooling mode and each unit is independent from the others. This means if one unit goes down, the whole system is not affected. Controls can be as simple as one unit, one thermostat. Water-Source and Geothermal Heat Pump systems are the most energy, cost, and space efficient of any system in the industry.

SYSTEM COMPARISON

System	Ease of Design	Ease of Installation	Installation Space	Installation Cost	Maintenance Requirements	Maintenance Costs	Future System Expansion	Sound Levels	Operating Costs	Total Zone Failure Chance	Individual Tenant Control	Options	Additional Auxiliary Equipment Needed	Structure Modification Needs	System Longevity
Two-Pipe Fan Coils	Low	Low	High	Med	High	High	Low	Low	Med	High	Low	Low	High	High	Med
Four-Pipe Fan Coils	Low	Low	High	High	High	High	Low	Low	High	High	Low	Low	High	High	Med
PTAC / PTHP	Low	Low	Low	Low	High	High	Med	High	High	Low	Med	Low	Med	High	Low
VAV	Low	Low	High	Med	High	High	Low	Med	Med	High	Low	Low	High	High	Med
Rooftop	Low	Low	High	Low	Med	High	Low	Med	Med	High	Low	Low	Med	High	Med
Water-source Heat Pumps	High	High	Low	Low	Low	Low	High	Low	Low	Low	High	High	Low	Low	High
Geothermal Heat Pumps	High	High	Low	Low	Low	Low	High	Low	Low	Low	High	High	Low	Low	High

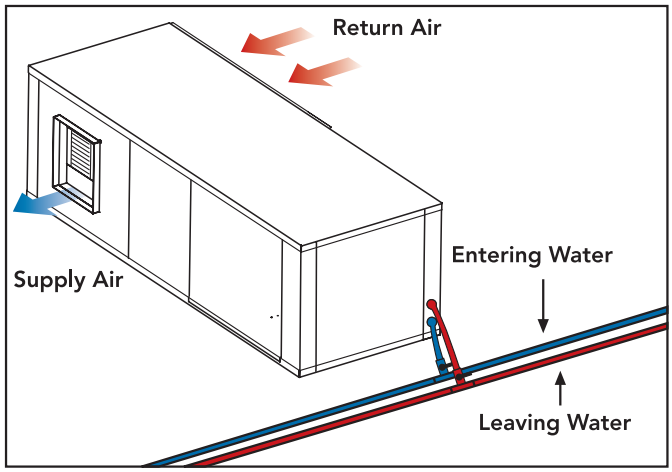
WATER-SOURCE HEAT PUMPS

As the most energy efficient HVAC systems on the market, Water-Source Heat Pumps are uniquely simple in design. Heat is moved through an interconnected water loop and either rejected through a cooling tower, or put to work in other areas. Each unit is an independent, packaged system, eliminating the chance of a total system failure. If one unit goes down, the other units are not affected. Conveniently located above the ceiling or in a closet, units can be easily accessed.

SYSTEM MODES

Water-Source Heat Pump systems can operate in one of four modes depending on the space conditioning requirements. The versatility of operation allows Water-Source Heat Pumps to show their full potential as a solution for customized comfort and flexibility.

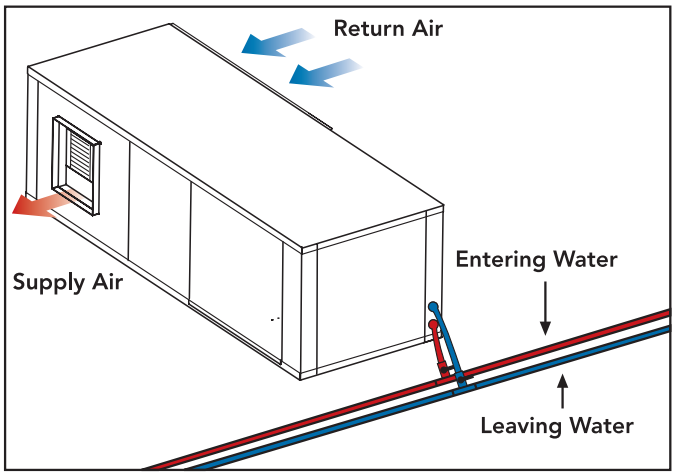
COOLING MODE



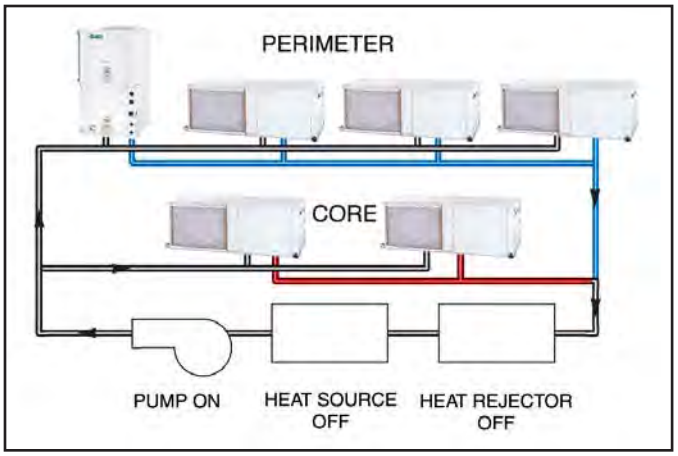
The system extracts heat from the air and rejects it into the water loop through the coaxial refrigerant-to-water heat exchanger. This heat can either be moved to a different part of the building to satisfy a heating mode requirement, or be rejected out of the building via a cooling tower.

HEATING MODE

The system extracts heat from the water loop through the coaxial heat exchanger and compresses it to a higher temperature. This heat is then transferred into the air through the air coil and used to condition the building space. A nominally sized boiler is often used to maintain a constant temperature of 60 to 70°F in the water loop during high heating demand months. Within this temperature range, the units can operate in either heating or cooling mode.



BALANCED MODE



A mixture of units in heating mode and units in cooling mode create a constant temperature in the water loop. In Balanced Mode, there is no need for heat injection or rejection via the boiler or cooling tower. The heat is simply moved from one zone to another.

DEHUMIDIFICATION MODE

The system, using a multi-speed blower and separate humidistat, slows the air movement across the air-coil to extract moisture and provide a more comfortable space. An additional reheat coil is available on select products for those climates where high humidity is a problem.

GEOTHERMAL SYSTEMS

These "Boilerless/Towerless" Heat Pump systems use the natural thermal properties of the Earth to dissipate or capture heat for the water loop. Geothermal Heat Pumps operate in an identical fashion to Water-Source Heat Pump units. However, without the need for a boiler or cooling tower, they save substantial energy costs and space. The water loop system is underground and the units are inside the building. Thus, the environmentally friendly geothermal system preserves the architectural design of a building naturally.

GEOTHERMAL EARTH LOOPS

Geothermal Earth Loops come in several different configurations depending on space availability and soil properties. Chances are at some point you have either stood over, or walked across a geothermal loop field. Loop fields can be located under parking lots, landscaped areas, or any number of other locations. All earth loops use high-density polyethylene pipe to circulate either water or an antifreeze mixture. All joints and connection fittings are thermally fused to prevent leaks and most piping comes with a 25-year or longer warranty.

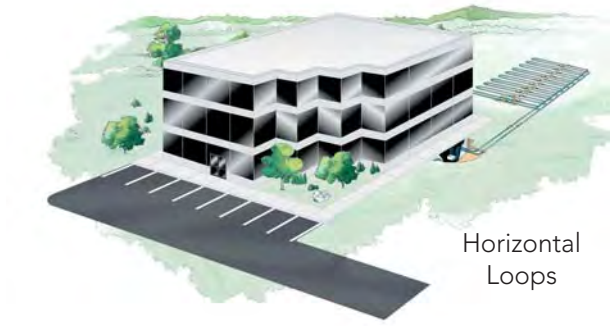
VERTICAL LOOPS

Vertical loops utilize bore holes drilled to an average depth of 250 feet. Once the loop pipe is inserted into the bore, it is grouted using a Bentonite mixture for maximum thermal conductivity. When space is a limited, vertical loops are the most common type of geothermal loop installed.

Vertical Loops

HORIZONTAL LOOPS

Horizontal loops utilize trenches dug to an average depth of four to six feet. As one of the more cost effective loops to install, horizontal loops are commonly found in open fields, parks or under parking lots.



Horizontal Loops

LAKE LOOPS

Lake loops utilize a "slinky" assembly of geothermal loop piping placed at the bottom of a pond, lake, or other large body of water. An extremely cost effective loop system, lake loops are an easy alternative if the option is available.

Lake Loops

WELL SYSTEMS

Most commonly known as "Open Loop", well systems pump water out of a nearby body of water or water well, and then discharge the water into another body of water or water well. Well systems usually employ a plate heat exchanger inside the building to keep the building water loop separated from the well water. This prevents any contaminates from affecting unit performance and extends system life. Well systems are often the most efficient as the well water is always at the same temperature year-round.

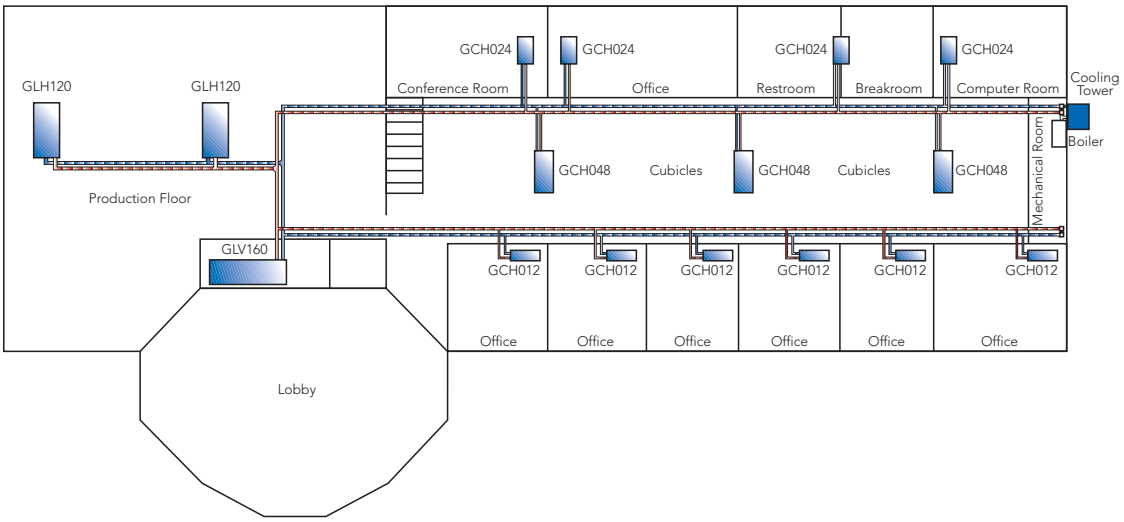
Well Systems

A WATER-SOURCE EXAMPLE

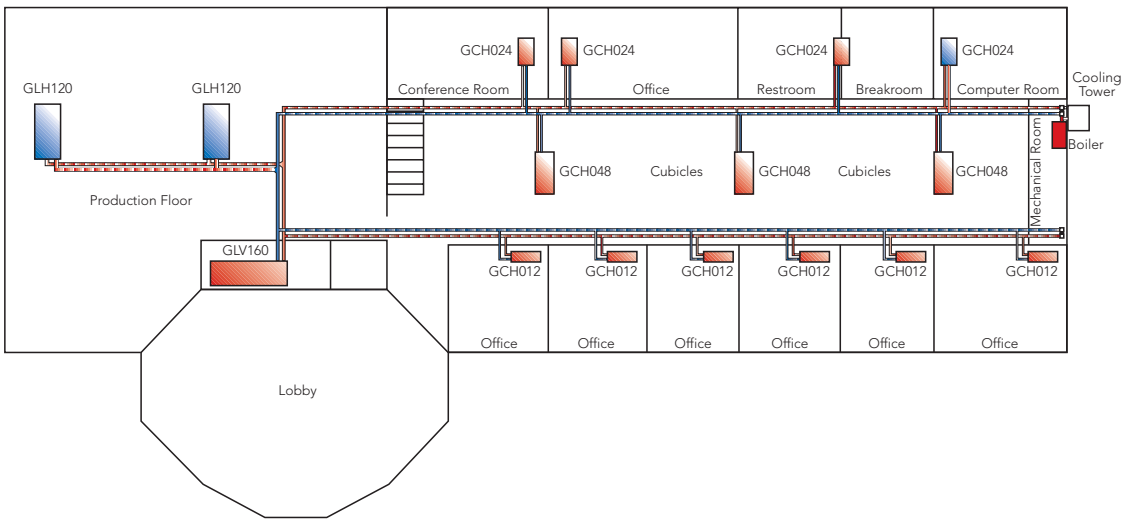
As an example of how Water-source Heat Pumps can handle a variety of different applications, the building shown to the right is a fictional bronze statue foundry company in the midwest portion of the United States. The first floor comprises their production floor and office space. The second floor of the building is reserved for future use. The cooling tower and boiler work as needed to maintain an average loop temperature between 60 to 95°F. Water-source Heat Pumps can efficiently operate in either heating, or cooling mode under these conditions. This gives individual and specialized zone control for maximum comfort and the ability to change operation modes as needed.

A mixture of units in heating mode and units in cooling mode create a constant temperature in the water loop. In Balanced Mode, there is no need for heat injection or rejection via the boiler or cooling tower. The heat is simply moved from one zone to another.

WARM WEATHER (HIGH COOLING DEMAND)



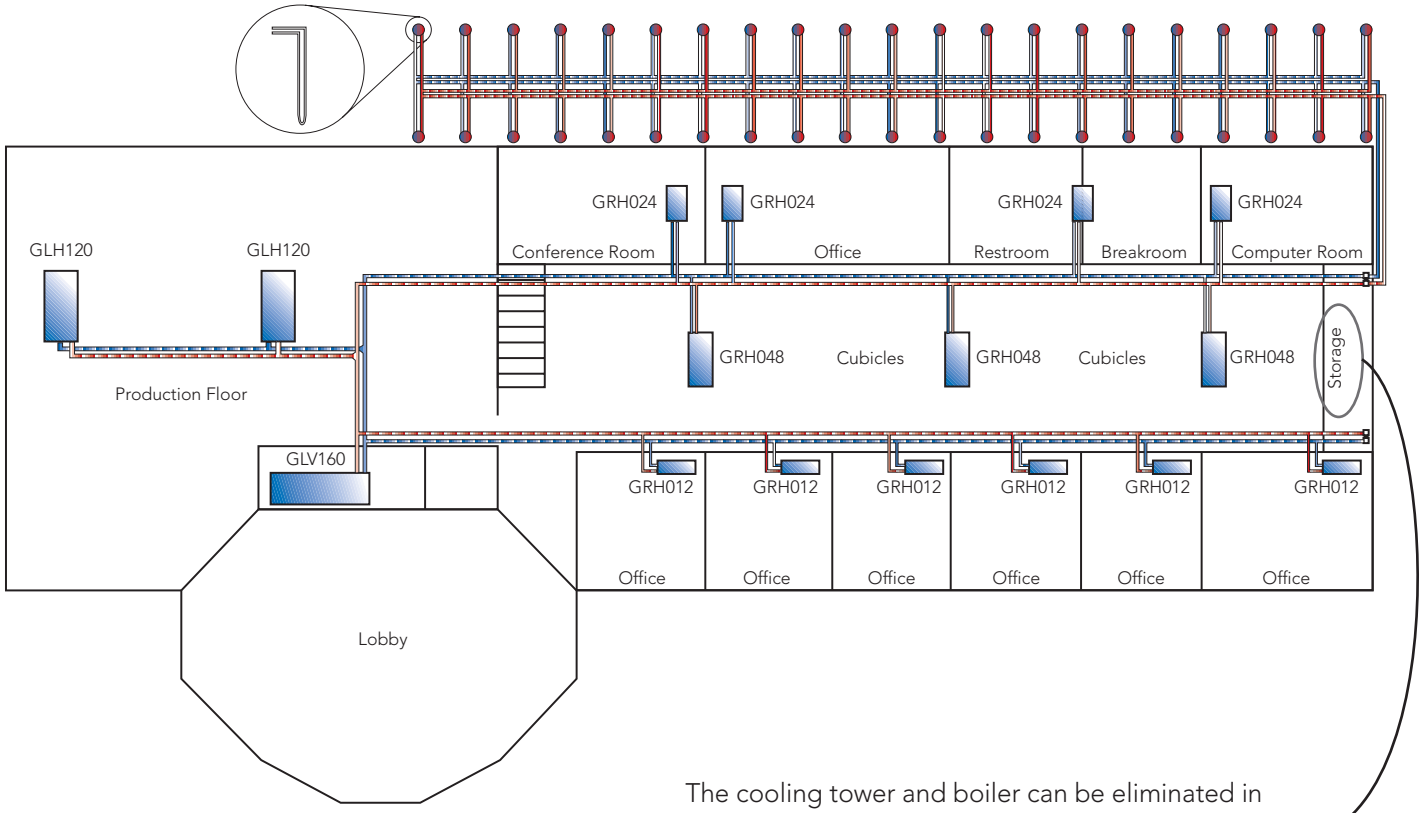
COOL WEATHER (HIGH HEATING DEMAND)



A GEOTHERMAL EXAMPLE

Using the same building model, the cooling tower and boiler are replaced with a geothermal vertical loop field. Identical in overall zone operation, the building benefits by having less overall equipment and reduced operation costs. Building aesthetics are also improved by eliminating outdoor equipment and additional space is gained by eliminating the boiler and additional support equipment.

WARM WEATHER (HIGH COOLING DEMAND)



The cooling tower and boiler can be eliminated in the geothermal application freeing up space used for equipment for other use. Only a small amount of room is needed for loop circulation equipment.

THE CLIMATEMASTER ADVANTAGE

WHO IS CLIMATEMASTER?

Who is ClimateMaster? ClimateMaster emerged from the marriage of several Water-Source heat pump companies in a blending of strengths to form a focused organization. For over 50 years, we have been focused on enhancing business and home environments around the world. Our mission as the world's largest and most progressive leader in the Water-Source and geothermal heat pump industry reveals our commitment to excellence - not only in the design and manufacture of our products, but in our people and services.

CLIMATEMASTER DESIGN

From concept to product, ClimateMaster's Integrated Product Development Team brings a fusion of knowledge and creativity that is unmatched in the industry today. Drawing from every aspect of our business: Engineering, Sales, Marketing, and Manufacturing, our Development Team has created some of the most advanced, efficient, and versatile products available.

INNOVATION, CONCEPT, NEEDS

Great products are born from necessity. Whether it is a need to reduce sound, fit in a smaller space, make easier to service, achieve better efficiencies, or due to changing technologies, or new government regulations, ClimateMaster leads the industry in advancing the form, fit and function of Water-Source and geothermal heat pumps. Our Design Team continually strives for even the slightest improvement to our products. It is this continual drive for excellence that sets ClimateMaster apart from all other manufacturers.

START TO FINISH

At ClimateMaster, every product development project begins with a comprehensive set of specifications. These specifications are a culmination of input from the market, a specific need, or a number of other factors. From these detailed specifications, prototypes are constructed and testing begins. After a rigorous testing period in ClimateMaster's own state-of-the-art lab facility, the data is compared to the project specifications. Once the Design Team is satisfied that all of the specs are met, the unit is sent to the production department for pilot runs. After the pilot runs are completed, unit literature is finalized and the product is released to the marketplace. Every unit we produce follows this strict and sequenced path insuring no stone is left unturned, and no detail is missed.

CLIMATEMASTER PRODUCTION

Innovative products demand innovative manufacturing processes. ClimateMaster's integrated production process combines every aspect of the manufacturing of our equipment into an organized, balanced, and controlled whole.

FABRICATION

Every sheet-metal component of a ClimateMaster unit is produced in our fabrication department. Panels are precisely constructed of galvanized or stainless steel using computerized cutting, punching, and forming equipment. This precise fabrication means a tighter fit that makes for a more solid unit and reduced vibration, which equals reduced noise. On certain series, an optional epoxy powder coating is then applied to increase corrosion resistance and enhance the look of the unit. The final step is the addition of fiberglass insulation to the inside as an additional layer of sound deadening. This insulation meets stringent NFPA regulations, and includes antibacterial material.

ASSEMBLY

ClimateMaster's 250,000 square foot production facility produces over 50,000 units per year using the most stringent quality control standards in the industry. Each unit is assembled under the close supervision of our Integrated Process Control System or IPCS. This multi-million dollar computer system watches each unit as it comes down the assembly line. To back up the IPCS system, our Quality department is stationed on each line and performs random audits not only on the units, but also on component parts. All component parts must pass each and every quality checkpoint before a unit is packaged and shipped. These systems and processes are maximized due to the comprehensive and ongoing training every employee receives from the date they are hired.

COMPONENT PARTS

To produce a quality unit, you have to start with quality components. ClimateMaster's purchasing department is relentless in its search for the best components for our products - while securing these components at prices that keep costs low. Any new component must go through a grueling testing phase before it ever sees the production line. Working closely with vendors and their engineers, we continually find new ways to not only improve our units, but to ensure component quality as well. Sister companies like KOAX, who produce our coaxial heat exchangers, allow ClimateMaster to provide components specifically designed for our applications

CLIMATEMASTER CERTIFICATION

ClimateMaster leads the industry in product awards and certifications. From 100% Air-Conditioning and Refrigeration Institute (ARI) performance ratings to industry awards for innovation, ClimateMaster applies cutting-edge technology to every product we design and manufacture.

ClimateMaster's new Tranquility 27™ series has won multiple awards and is taking the industry by storm. Hot off the heels of winning The News Bronze Dealer Design Award, the Tranquility 27™ won Best of Show at ComforTech in September 2004. You know you are doing great things when a lot of people tell you so.

ENGINEERING LAB FACILITIES

ClimateMaster has one of the largest testing facilities of any Water-Source heat pump manufacturer. Innovation and product improvements are a mainstay of the ClimateMaster Engineering Lab. Our people are what make the difference in the development of superior products in a timely manner. Our certified facility has six automated test cells capable of testing a wide variety of unit types under varying conditions. These cells are capable of producing data twenty-four hours a day, seven days a week. The development time of equipment is significantly reduced allowing ClimateMaster Engineers and Lab Technicians to spend more time on the actual development process. This team effort has allowed us to maintain a high degree of competence in our industry. Our test cells and test equipment are calibrated and certified periodically, per recognized industry standards, to insure the data is accurate and repeatable. In addition to testing new concept units, the lab continually audits production units throughout the year to insure quality performance and reliability.

INDUSTRY AFFILIATIONS AND ASSOCIATIONS

ClimateMaster works closely with the International Standards Organization (ISO), the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE), the Canadian Standards Association (CSA-US), the Electrical Testing Laboratories (ETL), and Conformité Européene (CE) to insure that our equipment not only meets the highest performance standards, but meets the highest industry standards as well. In a recent milestone, **ClimateMaster celebrated three consecutive years of 100% success rate in ARI's performance certification program**. An uncommon feat in the industry, this award is a testament to the craftsmanship, design, and construction of every ClimateMaster unit.

CUSTOMER SERVICE

ClimateMaster has gone to great lengths to meet our customers' business-to-business needs. ClimateMaster provides great products and our customer support is second to none. Our highly trained and experienced Customer Service department is available to assist you. Visit our on-line Business Center or contact Tech Services for any information you may need.

WWW.CLIMATEMASTER.COM

Our web site has become the central hub for all of our customers' information needs. Current literature, specifications, presentations, and other resources are readily available in an intuitive, easy- to-navigate format. At the click of a mouse, our new on-line Business Center allows you to check the status of your orders, lookup sales history, manage contact information, and even order literature, accessories, and units. Combined with our unique EZ-ORDER and EZ-SEND software, we take all the effort and guesswork out of unit orders.

ENGINEERING DESIGN SPECIFICATIONS

Advanced units need advanced specifications. ClimateMaster's new Engineering Design specifications provide the most detailed information for your next project.

LITERATURE

At ClimateMaster, Innovation never sleeps. As new advances are made, and new products are released, the need for accurate literature becomes critical. Every piece of technical literature that ClimateMaster produces is printed in our state-of-the-art on-demand printing facility. What this means is that we print only the literature we need at the time we need it. This insures that only the most current and accurate data is in the field.

SHIPPING

When you need that critical service part or piece of literature for your next presentation, you may rest assured that ClimateMaster has a shipping option for you. Networked with a variety of carriers such as FedEx, Watkins, Estes, Central Freight, Dugan, and many others, we provide fast and reliable shipping to anywhere in the world.

THE FUTURE OF CLIMATEMASTER

Our long history of innovation has paved the way for future endeavors with a solid platform of success. Growing markets in Europe and Asia demand a different way of not only manufacturing our products, but also successfully marketing them. New government regulations will phase out R-22 refrigerant at the beginning of 2010 paving the way for new R-410a, a much more environmentally friendly refrigerant. Additionally, new federally mandated efficiency increases of 30% becomes effective in January of 2006. In looking ahead, we continually strive for better processes, better designs, and better innovations that will keep ClimateMaster as the Global Leader in Water-Source and Geothermal Heat Pumps.

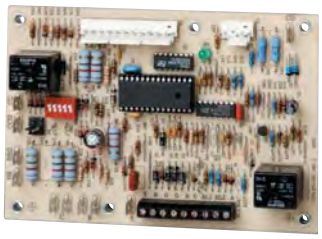
ADVANTAGE EXCLUSIVES

Being a leader in innovation, ClimateMaster brings industry firsts, as well as industry exclusives, to our family of products.

CONTROLS

ClimateMaster offers two levels of solid-state digital controls; the CXM and DXM control board.

CXM



Our standard CXM control board comes programmed with ClimateMaster's Unit Performance Sentinel (UPS) which monitors unit performance and notifies the owner of potential unit problems before a lockout occurs. Additionally, the CXM's eight standard safeties protect the unit from damage.

- Anti-Short Cycle
- Low Voltage
- High Voltage
- High Refrigerant Pressure
- Low Refrigerant Pressure (Loss of Charge)
- Air Coil Freeze (Excluding GC Series)
- Water Coil Freeze
- Condensate Overflow

DXM

Our enhanced controls option, the DXM control board offers all of the advantages of the CXM board but adds the following additional features:

- Multi-Stage Operation
- Night Setback
- Emergency Override
- Reheat Control
- Boilerless Electric Heat

DDC CONTROLS

Factory mounted LONWorks or Multi-ProtoCol (MPC) DDC controllers are an available option on all ClimateMaster products. These controllers give owners the ability to implement a variety of building automation systems such as BACnet, ModBus, and Johnson N2. Through a web enabled PC, individual units, unit zones, and entire building systems can be monitored and controlled with the click of a mouse. The systems provide unit status, set-point control, performance curves, and fault indications.

CONFIGURATIONS

No other manufacturer provides as many size,

performance, configuration, and cost options as the ClimateMaster family of products offers. From our smallest horizontal unit in the GCH006, to our largest vertical in the GLV300, to our Rooftop series with available 100% make-up air (when mated with the Rx ERV), to the console, water-to-water, and two-stage Tranquility 27™, we have a unit to fit your application.

SOUND

Prior to the recently adopted sound standard ARI 260-2000 there had been no standard for the evaluation of Water-Source heat pump sound performance. Also, those manufacturers who did generate and publish their own sound data, did so in their own labs making it difficult to have the data independently certified and accurate comparisons were therefore, impossible. Now that a standard has been established, it is critical to compare the data correctly. If data from two manufacturers is compared using different test procedures, results are not comparable. ClimateMaster has tested its product line for both ducted discharge and free inlet air combined with case radiated tests. Comfort has never been so quiet with our intelligent sound design. Our products use a variety of technologies to maintain our lead as the quietest units in the industry.

DUAL LEVEL VIBRATION ISOLATION

ClimateMaster units use an exclusive double isolation compressor mounting system. This dual level isolation deadens vibration and provides quiet operation.

TORSION-FLEX BLOWERS

Blower motors ,on select models, are mounted with a unique torsion-flex mounting system which not only allows for easy service, but also reduces vibration from the blower motor during operation.

ULTRAQUIET

ClimateMaster's optional additional sound suppression package enhances our already excellent sound performance through the use of dual density acoustical insulation and other strategically placed sound attenuating materials. No other manufacturer's mute package comes close to matching the performance of the UltraQuiet package.

E-COATED AIR COILS

All ClimateMaster Water-Source heating and cooling systems (excluding the RE series rooftop) are available with an E-Coated air-coil option. This process provides years of protection against coil corrosion from airborne chemicals resulting from modern building material outgassing and most airborne environmental chemicals. In fact, ClimateMaster's exclusive E-Coated air-coils enhance corrosion protection to nearly 20 times that of a traditional uncoated coil.*

* Test based upon ASTM B117 Salt Spray test hours.

CLIMADRY REHEAT

Continuing to lead the industry in IAQ (Indoor Air Quality) solutions, select ClimateMaster units are available with an innovative method (patent pending) of reheating the air. The ClimaDry microprocessor-controlled option will automatically provide 100% reheat by adjusting the amount of reheat capacity based upon supply air temperature. This new approach to reheat provides dehumidified, neutral temperature supply air, while eliminating the problem of overcooling the space when loop temperatures drop. All components are internal to the unit, saving space and keeping installation costs low. A simple humidistat or DDC controls activates the option.

VOLTAGES

ClimateMaster units are available in a wide variety of commercial voltages, providing maximum flexibility in building design. Available voltages are as follows:

- 208-230/60/1
- 208-230/60/3
- 265/60/1
- 460/60/3
- 575/60/3
- 220-240/50/1
- 380-420/50/3

* Not all units are available with every voltage combination shown above.

ACCESSORIES

ClimateMaster offers a complete line of accessories to complete any project, including hoses, thermostats, valves, pumps, fittings, controllers, sensors, filters and more.

ClimateMaster Water-Source Heat Pumps
Tranquility Modular (TRM) Series
0.75 to 3 Ton Vertical Hi-Rise Units

TRANQUILITY VERTICAL STACK (TRM) SERIES WITH EARTHPURE® REFRIGERANT

The Tranquility Vertical Stack (TRM) series offers an innovative, labor-saving solution for spaces where individual, quiet control of the heating and cooling system is important. TRM units' pre-piped risers and pre-wired cabinets are especially ideal for multi-story buildings. Cabinets can operate as stand-alone "ductless" systems, or can be ducted to an adjacent room, making them convenient for low-rise buildings as well. The TRM series exceeds ASHRAE 90.1 efficiencies, yet maintains small cabinet dimensions. Using EarthPure refrigerant, the Tranquility console not only protects the environment, it does so while delivering unprecedented comfort, efficiency, and reliability.

Available in sizes 3/4 ton (2.6 kW) through 3 tons (10.6 kW) with numerous cabinet, water piping and control choices, the TRM series offers a wide range of units for most any installation. The TRM has an extended range refrigerant circuit, capable of ground loop (geothermal) applications as well as water loop (boiler-tower) applications. Standard features are many. Microprocessor controls, TXV metering device, galvanized steel cabinet, torsion-flex blower motor mounting, and (optional) e-coated air coil are just some of the features of the innovative TRM series.

ClimateMaster's exclusive double isolation compressor mounting system makes the TRM series the quietest vertical stack units on the market. Compressors are mounted on rubber grommets to a heavy gauge mounting plate, which is then isolated from the cabinet base with vibration isolation springs for maximized vibration/sound attenuation. Options such as DDC controls, internal pump and factory-installed water solenoid valves allow customized design solutions.

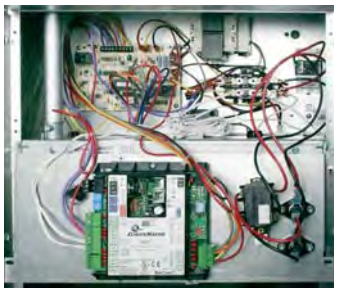
The TRM Series vertical stack water-source heat pumps are designed to meet the challenges of today's HVAC demands with a low cost/high value solution.

UNIT FEATURES

- Sizes 09 (3/4 ton, 2.6 kW) through 36 (3 ton, 10.6 kW)
- Environmentally-friendly EarthPure® (HFC-410A) zero ozone depletion refrigerant
- High efficiency rotary and scroll compressors
- Exceeds ASHRAE 90.1 efficiencies
- Removable chassis allows staged installation and ease of maintenance
- Galvanized steel cabinet
- Unique double isolation compressor mounting for quiet operation
- TXV metering device
- Unit or remote-mounted controls available
- Microprocessor controls standard (optional DXM and/or DDC controls)
- LonWorks, BACnet, Modbus and Johnson N2 compatibility options for DDC controls
- Unit Performance Sentinel performance monitoring system
- Integrated drain pan with condensate overflow sensor
- Attractive return air panel with hinged access door ("G" panel)
- Multiple supply air discharge options
- Stainless steel braided hose kits for connection from piping risers to chassis
- Eight Safeties Standard
- Wide variety of options including disconnect switch and internal pumps

Torsion-flex blower motors

Stainless steel braided flexible hoses allow quick connection from the piping (risers) to the chassis and allow easy removal of the chassis



Advanced digital controls with Remote Service Sentinel Enhanced controls shown with optional DDC Controllers (MPC)

Integrated Drain Pan with condensate overflow protection (Optional Stainless Steel Drain Pan)

Removable chassis allows staged installation and ease of maintenance/service once installation is complete

Exclusive dual-level compressor isolation lowers vibration and reduces noise for quiet operation

Features EarthPure® HFC-410A zero ozone depletion refrigerant

About ARI/ISO/ASHRAE 13256-1

The performance standard ARI/ASHRAE/ISO 13256-1 became effective January 1, 2000 and replaces ARI Standards 320, 325, and 330. This new standard has three major categories: Water Loop (comparable to ARI 320), Ground Water (ARI 325), and Ground Loop (ARI 330). Although these standards are similar there are some differences:

Entering Water Conditions Changes
Entering water temperatures have changed to reflect the centigrade temperature scale. For instance the water loop heating test is performed with 68°F (20°C) water instead of 70°F.

Entering Air Condition Changes
Entering air temperatures have changed to reflect the centigrade temperature scale. For instance the cooling tests are performed with 80.6°F (27°C) dry bulb and 66.2°F (19°C) wet bulb entering air instead of the traditional 80°F DB and 67°F WB entering air temperatures. 80/67 and 70 data (as presented in performance data on pages 16-26) may be converted to the new ISO conditions of 80.6/66.2 and 68 using the entering air correction table on page 14.

Pump Power Correction
Within each model, only one water flow rate is specified for all three groups and pumping watts are calculated using the following formula. This additional power is added onto the existing power consumption.

Pump power correction = (gpm x 0.0631) x (Press Drop x 2990) / 300
Where 'gpm' is waterflow in gpm and 'Press Drop' is the pressure drop through the unit heat exchanger at rated water flow in feet of head.

Fan Power Correction
Fan power is corrected to zero external static pressure using the following equation. The nominal airflow is rated at a specific external static pressure. This effectively reduces the power consumption of the unit and increases cooling capacity but decreases heating capacity. These watts are significant enough in most cases to increase EER and COP's fairly dramatically over ARI 320, 325, and 330 ratings.

Fan Power Correction = (cfm x 0.472) x (esp x 249) / 300
Where 'cfm' is airflow in cfm and esp is the external static pressure at rated airflow in inches of water gauge.

ISO Capacity and Efficiency Equations
The following equations illustrate cooling calculations:

ISO Cooling Capacity = Cooling Capacity (Btuh) + (Fan Power Correction (Watts) x 3.412)
ISO EER Efficiency (W/W) = [ISO Cooling Capacity (Btuh) ÷ 3.412] / [Power Input (watts) – Fan Power Correction (watts) + Pump Power Correction (watt)]

The following equations illustrate heating calculations:

ISO Heating Capacity = Heating Capacity (Btuh) - (Fan Power Correction (Watts) x 3.412)
ISO COP Efficiency (W/W) = [ISO Heating Capacity (Btuh) ÷ 3.412] / [Power Input (watts) - Fan Power Correction (watts) + Pump Power Correction (watt)]

	ARI 320	ISO WLHP	ARI 325	ISO GWHP	ARI 330	ISO GLHP
Cooling						
Entering Air -DB/WB °F	80/67	80.6/66.2	80/67	80.6/66.2	80/67	80.6/66.2
Entering Water -°F	85	86	50/70	59	77	77
Fluid Flow Rate	Note 1	Note 2	Note 2	Note 2	Note 2	Note 2
Heating						
Entering Air -°F	70	68	70	68	70	68
Entering Water -°F	70	68	50/70	50	32	32
Fluid Flow Rate	Note 1	Note 2	Note 2	Note 2	Note 2	Note 2

Note 1: Flow rate is set by 10°F rise in standard cooling test.
Note 2: Flow rate is specified by manufacturer.

Rev.: 3/09/01

ARI/ISO/ASHRAE 13256-1 Data

ASHRAE/ARI/ISO 13256-1. English (IP) Units

Model	Water Loop Heat Pump				Ground Water Heat Pump				Ground Loop Heat Pump			
	Cooling 86°F		Heating 68°F		Cooling 59°F		Heating 50°F		Cooling 77°F		Heating 32°F	
	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP
TRM09	8,800	13.0	12,500	4.6	10,100	19.5	9,800	3.8	9,300	14.7	7,200	3.1
TRM12	11,600	13.0	15,800	4.5	13,700	20.0	12,700	3.8	12,200	15.0	9,500	3.1
TRM15	13,800	13.0	19,600	4.7	16,500	20.0	15,500	3.9	15,200	14.6	11,500	3.1
TRM18	16,700	13.0	22,600	4.7	19,600	19.5	18,200	3.8	17,600	14.6	14,000	3.1
TRM24	22,100	13.0	29,400	4.5	26,400	20.0	23,100	3.8	23,600	14.8	18,000	3.1
TRM30	27,100	13.0	33,100	4.6	30,600	18.6	27,700	4.0	29,200	16.0	20,600	3.1
TRM36	32,000	12.5	39,500	4.6	36,700	18.8	32,000	3.8	33,000	14.3	25,000	3.1

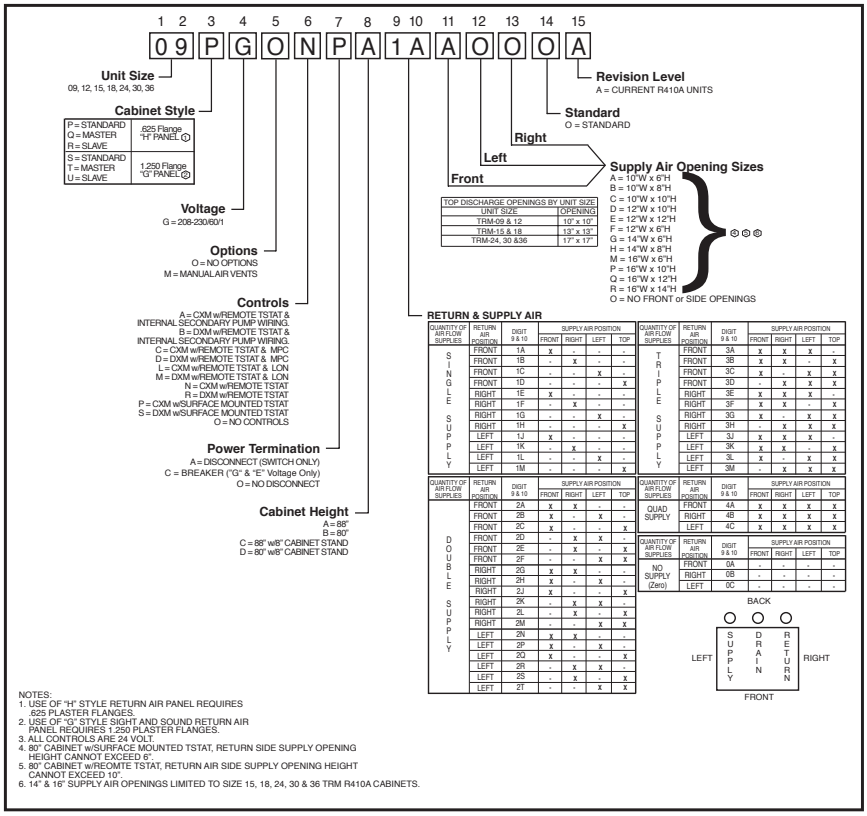
Cooling capacities based upon 80.6°F DB, 66.2°F WB entering air temperature
Heating capacities based upon 68°F DB, 59°F WB entering air temperature
All air flow is rated on high speed
All ratings based upon operation at lower voltage of dual voltage rated models

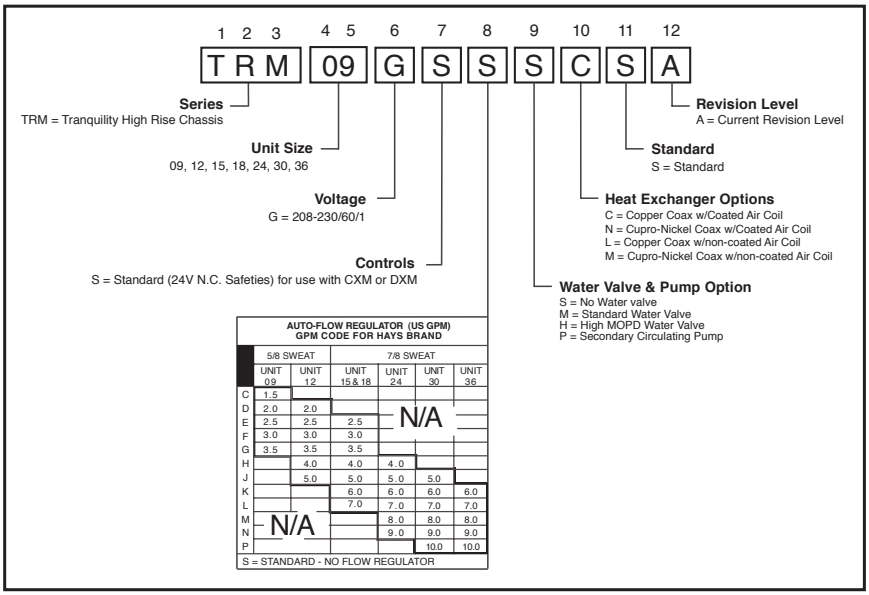
ASHRAE/ARI/ISO 13256-1. Metric (SI) Units

Model	Water Loop Heat Pump				Ground Water Heat Pump				Ground Loop Heat Pump			
	Cooling 30°C		Heating 20°C		Cooling 15°C		Heating 10°C		Cooling 25°C		Heating 0°C	
	Capacity Watts	EER W/W	Capacity Watts	COP	Capacity Watts	EER W/W	Capacity Watts	COP	Capacity Watts	EER W/W	Capacity Watts	COP
TRM09	2,579	3.8	3,664	4.6	2,930	5.7	2,872	3.8	2,726	4.3	2,110	3.1
TRM12	3,400	3.8	4,631	4.5	4,015	5.9	3,722	3.8	3,576	4.4	2,784	3.1
TRM15	4,045	3.8	5,744	4.7	4,836	5.9	4,543	3.9	4,455	4.3	3,370	3.1
TRM18	4,894	3.8	6,624	4.7	5,744	5.7	5,334	3.8	5,158	4.3	4,103	3.1
TRM24	6,477	3.8	8,617	4.5	7,737	5.9	6,770	3.8	6,917	4.3	5,276	3.1
TRM30	7,943	3.8	9,701	4.6	8,969	5.5	8,118	4.0	8,558	4.7	6,038	3.1
TRM36	9,379	3.7	11,577	4.6	10,756	5.5	9,379	3.8	9,672	4.2	7,327	3.1

Cooling capacities based upon 27°C DB, 19°C WB entering air temperature
Heating capacities based upon 20°C DB, 15°C WB entering air temperature
All air flow is rated on high speed
All ratings based upon operation at lower voltage of dual voltage rated models

Model Nomenclature


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
0 9 P G O N P A 1 A A O O O A
Unit Size
09, 12, 15, 18, 24, 30, 36
Cabinet Style
P = STANDARD
Q = MASTER
R = SLAVE
.625 Flange "H" PANEL (1)
S = STANDARD
T = MASTER
U = SLAVE
1.250 Flange "G" PANEL (2)
Voltage
G = 208-230/60/1
Options
O = NO OPTIONS
M = MANUAL AIR VENTS
Controls
A = CXM w/REMOTE TSTAT & INTERNAL SECONDARY PUMP WIRING.
B = DXM w/REMOTE TSTAT & INTERNAL SECONDARY PUMP WIRING.
C = CXM w/REMOTE TSTAT & MPC
D = DXM w/REMOTE TSTAT & MPC
L = CXM w/REMOTE TSTAT & LON
M = DXM w/REMOTE TSTAT & LON
N = CXM w/REMOTE TSTAT
R = DXM w/REMOTE TSTAT
P = CXM w/SURFACE MOUNTED TSTAT
S = DXM w/SURFACE MOUNTED TSTAT
O = NO CONTROLS
Power Termination
A = DISCONNECT (SWITCH ONLY)
C = BREAKER ("G" & "E" Voltage Only)
O = NO DISCONNECT
Cabinet Height
A = 88"
B = 80"
C = 88" w/8" CABINET STAND
D = 80" w/8" CABINET STAND
Revision Level
A = CURRENT R410A UNITS
Standard
O = STANDARD
Right
Left
Front
Supply Air Opening Sizes
A = 10"W x 6"H
B = 10"W x 8"H
C = 10"W x 10"H
D = 12"W x 10"H
E = 12"W x 12"H
F = 12"W x 6"H
G = 14"W x 6"H
H = 14"W x 8"H
M = 16"W x 6"H
P = 16"W x 10"H
Q = 16"W x 12"H
R = 16"W x 14"H
O = NO FRONT or SIDE OPENINGS
TOP DISCHARGE OPENINGS BY UNIT SIZE
UNIT SIZE | OPENING
TRM-09 & 12 | 10" x 10"
TRM-15 & 18 | 13" x 13"
TRM-24, 30 &36 | 17" x 17"
RETURN & SUPPLY AIR
SINGLE SUPPLY
TRIPLE SUPPLY
DOUBLE SUPPLY
QUAD SUPPLY
NO SUPPLY (Zeo)
QUANTITY OF AIR FLOW SUPPLIES | RETURN AIR POSITION | DIGIT 9 & 10 | SUPPLY AIR POSITION: FRONT | RIGHT | LEFT | TOP
FRONT 1A x - - -
FRONT 1B - x - -
FRONT 1C - - x -
FRONT 1D - - - x
RIGHT 1E x - - -
RIGHT 1F - x - -
RIGHT 1G - - x -
RIGHT 1H - - - x
LEFT 1J x - - -
LEFT 1K - x - -
LEFT 1L - - x -
LEFT 1M - - - x
FRONT 2A x x - -
FRONT 2B x - x -
FRONT 2C x - - x
FRONT 2D - x x -
FRONT 2E - x - x
FRONT 2F - - x x
RIGHT 2G x x - -
RIGHT 2H x - x -
RIGHT 2J x - - x
RIGHT 2K - x x -
RIGHT 2L - x - x
RIGHT 2M - - x x
LEFT 2N x x - -
LEFT 2P x - x -
LEFT 2Q x - - x
LEFT 2R - x x -
LEFT 2S - x - x
LEFT 2T - - x x
FRONT 3A x x x -
FRONT 3B x x - x
FRONT 3C x - x x
FRONT 3D - x x x
RIGHT 3E x x x -
RIGHT 3F x x - x
RIGHT 3G x - x x
RIGHT 3H - x x x
LEFT 3J x x x -
LEFT 3K x x - x
LEFT 3L x - x x
LEFT 3M - x x x
FRONT 4A x x x
RIGHT 4B x x x
LEFT 4C x x x
FRONT 0A - - -
RIGHT 0B - - -
LEFT 0C - - -
BACK
LEFT
SUPPLY
DRAIN
RETURN
RIGHT
FRONT
NOTES:
1. USE OF "H" STYLE RETURN AIR PANEL REQUIRES .625 PLASTER FLANGES.
2. USE OF "G" STYLE SIGHT AND SOUND RETURN AIR PANEL REQUIRES 1.250 PLASTER FLANGES.
3. ALL CONTROLS ARE 24 VOLT.
4. 80" CABINET w/SURFACE MOUNTED TSTAT, RETURN SIDE SUPPLY OPENING HEIGHT CANNOT EXCEED 6".
5. 80" CABINET w/REOMTE TSTAT, RETURN AIR SIDE SUPPLY OPENING HEIGHT CANNOT EXCEED 10".
6. 14" & 16" SUPPLY AIR OPENINGS LIMITED TO SIZE 15, 18, 24, 30 & 36 TRM R410A CABINETS.


1 2 3 4 5 6 7 8 9 10 11 12
T R M 0 9 G S S S C S A
Series
TRM = Tranquility High Rise Chassis
Unit Size
09, 12, 15, 18, 24, 30, 36
Voltage
G = 208-230/60/1
Controls
S = Standard (24V N.C. Safeties) for use with CXM or DXM
Water Valve & Pump Option
S = No Water valve
M = Standard Water Valve
H = High MOPD Water Valve
P = Secondary Circulating Pump
Heat Exchanger Options
C = Copper Coax w/Coated Air Coil
N = Cupro-Nickel Coax w/Coated Air Coil
L = Copper Coax w/non-coated Air Coil
M = Cupro-Nickel Coax w/non-coated Air Coil
Standard
S = Standard
Revision Level
A = Current Revision Level
AUTO-FLOW REGULATOR (US GPM) GPM CODE FOR HAYS BRAND
5/8 SWEAT | 7/8 SWEAT
UNIT 09 | UNIT 12 | UNIT 15 & 18 | UNIT 24 | UNIT 30 | UNIT 36
C 1.5
D 2.0 2.0
E 2.5 2.5 2.5
F 3.0 3.0 3.0
G 3.5 3.5 3.5
H 4.0 4.0 4.0
J 5.0 5.0 5.0 5.0
K 6.0 6.0 6.0 6.0
L 7.0 7.0 7.0 7.0
M 8.0 8.0 8.0
N 9.0 9.0 9.0
P 10.0 10.0
N/A
S = STANDARD - NO FLOW REGULATOR

Reference Calculations

Heating

$$LWT = EWT - \frac{HE}{GPM \times 500}$$

$$LAT = EAT + \frac{HC}{CFM \times 1.08}$$

Cooling

$$LWT = EWT + \frac{HR}{GPM \times 500}$$

$$LAT\ (DB) = EAT\ (DB) - \frac{SC}{CFM \times 1.08}$$

$$LC = TC - SC$$

$$S/T = \frac{SC}{TC}$$

Legend and Glossary of Abbreviations

BTUH = BTU(British Thermal Unit) per hour
CFM = airflow, cubic feet/minute
COP = coefficient of performance = BTUH output/BTUH input
DB = dry bulb temperature (°F)
EAT = entering air temperature, Fahrenheit (dry bulb/wet bulb)
EER = energy efficiency ratio = BTUH output/Watt input
ESP = external static pressure (inches w.g.)
EWT = entering water temperature
GPM = water flow in U.S. gallons/minute
HE = total heat of extraction, BTUH
HC = air heating capacity, BTUH
HR = total heat of rejection, BTUH
HWC = hot water generator (desuperheater) capacity, Mbtuh
KW = total power unit input, kilowatts
LAT = leaving air temperature, °F
LC = latent cooling capacity, BTUH
LWT = leaving water temperature, °F
MBTUH = 1000 BTU per hour
S/T = sensible to total cooling ratio
SC = sensible cooling capacity, BTUH
TC = total cooling capacity, BTUH
WB = wet bulb temperature (°F)
WPD = waterside pressure drop (psi & ft. of hd.)

Conversion Table - to convert inch-pound (English) to SI (Metric)

Air Flow	Water Flow	Ext Static Pressure	Water Pressure Drop
Airflow (L/s) = CFM x 0.472	Water Flow (L/s) = gpm x 0.0631	ESP (Pa) = ESP (in of wg) x 249	PD (kPa) = PD (ft of hd) x 2.99

Correction Tables

Airflow	Cooling				Heating		
% of Rated	Total Capacity	Sensible Capacity	Power	Heat of Rejection	Heating Capacity	Power	Heat of Extraction
70%	0.921	0.800	0.969	0.943	0.942	1.077	0.934
75%	0.934	0.833	0.974	0.952	0.952	1.062	0.947
80%	0.946	0.866	0.979	0.961	0.961	1.048	0.958
85%	0.958	0.899	0.985	0.970	0.971	1.035	0.969
90%	0.971	0.932	0.990	0.979	0.980	1.023	0.979
95%	0.985	0.966	0.995	0.989	0.990	1.011	0.989
100%	1.000	1.000	1.000	1.000	1.000	1.000	1.000
105%	1.017	1.035	1.005	1.013	1.010	0.989	1.011

Heating			
Entering Air DB°F	Heating Capacity	Power	Heat of Extraction
45	1.107	0.768	1.181
50	1.085	0.814	1.143
55	1.064	0.860	1.108
60	1.043	0.906	1.072
65	1.022	0.952	1.036
68	1.009	0.981	1.015
70	1.000	1.000	1.000
75	0.982	1.050	0.962
80	0.953	1.103	0.921

Cooling										
Entering Air WB°F	Total Capacity	Sensible Cooling Capacity Multiplier - Entering DB °F							Power	Heat of Rejection
		70	75	80	80.6	85	90	95		
60	0.851	0.854	1.091	1.325	1.385	*	*	*	0.996	0.896
65	0.957	0.617	0.857	1.093	1.152	1.326	*	*	0.999	0.970
66.2	0.983	0.561	0.801	1.037	1.097	1.270	1.520	*	1.000	0.988
67	1.000	0.523	0.763	1.000	1.059	1.232	1.482	*	1.000	1.000
70	1.064		0.623	0.861	0.920	1.090	1.339	1.563	1.002	1.045
75	1.171			0.629	0.688	0.854	1.101	1.318	1.005	1.119

* = Sensible capacity equals total capacity
ARI/ISO/ASHRAE 13256-1 uses entering air conditions of Cooling - 80.6°F DB/66.2°F WB, 1 and Heating - 68°F DB/59°F WB entering air temperature

Antifreeze Type	Anitfreeze %	Cooling			Heating		WPD Corr. Fct. EWT 30°F
		EWT 90°F			EWT 30°F		
		Total Cap	Sens Cap	Power	Htg Cap	Power	
Water	0	1.000	1.000	1.000	1.000	1.000	1.000
Propylene Glycol	5	0.995	0.995	1.003	0.989	0.997	1.070
	15	0.986	0.986	1.009	0.968	0.990	1.210
	25	0.978	0.978	1.014	0.947	0.983	1.360
Methanol	5	0.997	0.997	1.002	0.989	0.997	1.070
	15	0.990	0.990	1.007	0.968	0.990	1.160
	25	0.982	0.982	1.012	0.949	0.984	1.220
Ethanol	5	0.998	0.998	1.002	0.981	0.994	1.140
	15	0.994	0.994	1.005	0.944	0.983	1.300
	25	0.986	0.986	1.009	0.917	0.974	1.360
Ethylene Glycol	5	0.998	0.998	1.002	0.993	0.998	1.040
	15	0.994	0.994	1.004	0.980	0.994	1.120
	25	0.988	0.988	1.008	0.966	0.990	1.200

Unit Model Number Designation
TRM = Vertical Stack Hi-Rise Heat Pump

Capacity Table Index
TRM-09 - TRM-36 - See Page 20-27.

Glossary of Terms
See Page 17.

Selection Procedure

Step 1 Determine the actual heating and cooling loads at the desired dry bulb and wet bulb conditions.

Step 2 Obtain the following design parameters: Entering water temperature, water flow rate in GPM, air flow in CFM, water flow pressure drop and design wet and dry bulb temperatures. Air flow CFM should be between 300 and 450 CFM per ton. Unit water pressure drop should be kept as close as possible to each other to make water balancing easier. Go to the appropriate tables and find the proper indicated water flow and water temperature.

Step 3 Select a unit based on total and sensible cooling conditions. Select a unit which is closest to, but no larger than, the actual cooling load.

Step 4 Enter tables at the design water flow and water temperature. Read the total and sensible cooling capacities (Note: interpolation is permissible, extrapolation is not).

Step 5 Read the heating capacity. If it exceeds the design criteria it is acceptable. It is quite normal for Water-Source Heat Pumps to be selected on cooling capacity only since the heating output is usually greater than the cooling capacity.

Step 6 Determine the correction factors associated with the variable factors of dry bulb and wet bulb (page 14).

Corrected Total Cooling = tabulated total cooling x wet bulb correction.
Corrected Sensible Cooling = tabulated sensible cooling x wet/dry bulb correction.

Step 7 Compare the corrected capacities to the load requirements. Normally if the capacities are within 10% of the loads, the equipment is acceptable. It is better to undersize than oversize, as undersizing improves humidity control, reduces sound levels and extends the life of the equipment.

Step 8 When completed, calculate water temperature rise and assess the selection. If the units selected are not within 10% of the load calculations, then review what effect changing the GPM, water temperature and/or air flow and air temperature would have on the corrected capacities. If the desired capacity cannot be achieved, select the next larger or smaller unit and repeat the procedure. Remember, when in doubt, undersize slightly for best performance.

Example Equipment Selection For Cooling

Step 1 Load Determination:
Assume we have determined that the appropriate cooling load at the desired dry bulb 80°F and wet bulb 65°F conditions is as follows:

Total Cooling ..... 15,100 BTUH
Sensible Cooling..... 10,500 BTUH
Entering Air Temp ..... 80°F Dry Bulb / 65°F Wet Bulb

Step 2 Design Conditions:
Similarly, we have also obtained the following design parameters:

Entering Water Temp ..... 90°F
Water Flow (Based upon 10°F rise in temp.) 4.5 GPM
Air Flow ..... 515 CFM

Step 3, 4 & 5 HP Selection:
After making our preliminary selection (TRM18), we enter the tables at design water flow and water temperature and read Total Cooling, Sens. Cooling and Heat of Rej. capacities:

Total Cooling ..... 16,800 BTUH
Sensible Cooling..... 12,500 BTUH
Heat of Rejection..... 21,300 BTUH

Step 6 & 7 Entering Air and Airflow Corrections:
Next, we determine our correction factors.

	Table		Ent Air		Air Flow		Corrected
Corrected Total Cooling =	16,800	x	0.957	x	0.934	=	15,016
Corrected Sens Cooling =	12,500	x	1.093	x	0.833	=	11,381
Corrected Heat of Reject =	21,300	x	0.970	x	0.952	=	19,669

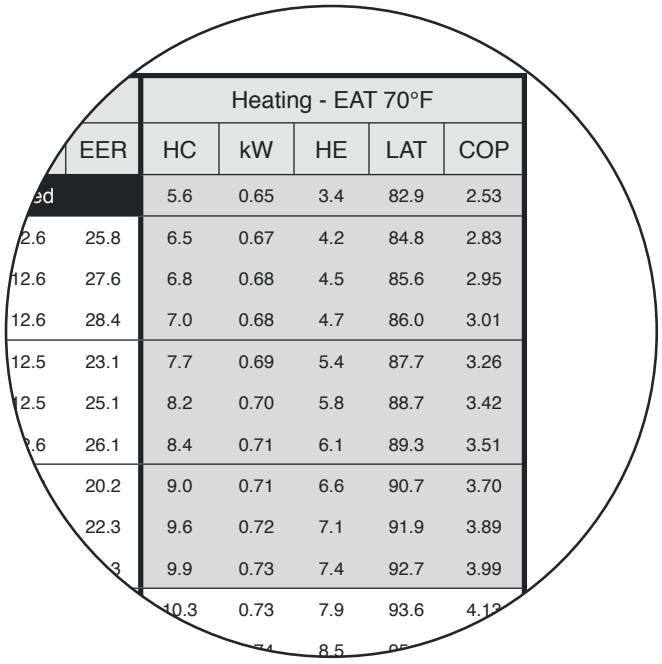
Step 8 Water Temperature Rise Calculation & Assessment:

Actual Temperature Rise 8.9°F

When we compare the Corrected Total Cooling and Corrected Sensible Cooling figures with our load requirements stated in Step 1, we discover that our selection is within +/- 10% of our sensible load requirement. Furthermore, we see that our Corrected Total Cooling figure is slightly undersized as recommended, when compared to the actual indicated load.

Performance Data
Selection Notes

For operation in the shaded area when water is used in lieu of an anti-freeze solution, the LWT (Leaving Water Temperature) must be calculated. Flow must be maintained to a level such that the LWT is maintained above 42°F [5.6°C] when the JW3 jumper is not clipped (see example below). This is due to the potential of the refrigerant temperature being as low as 32°F [0°C] with 40°F [4.4°C] LWT, which may lead to a nuisance cutout due to the activation of the Low Temperature Protection. JW3 should never be clipped for standard range equipment or systems without antifreeze.



		Heating - EAT 70°F				
	EER	HC	kW	HE	LAT	COP
ed		5.6	0.65	3.4	82.9	2.53
2.6	25.8	6.5	0.67	4.2	84.8	2.83
12.6	27.6	6.8	0.68	4.5	85.6	2.95
12.6	28.4	7.0	0.68	4.7	86.0	3.01
12.5	23.1	7.7	0.69	5.4	87.7	3.26
12.5	25.1	8.2	0.70	5.8	88.7	3.42
.6	26.1	8.4	0.71	6.1	89.3	3.51
	20.2	9.0	0.71	6.6	90.7	3.70
	22.3	9.6	0.72	7.1	91.9	3.89
	3	9.9	0.73	7.4	92.7	3.99
		10.3	0.73	7.9	93.6	4.13
				8.5		

Example:

At 50°F EWT (Entering Water Temperature) and 1.5 gpm/ton, a 3 ton unit has a HE of 22,500 Btuh. To calculate LWT, rearrange the formula for HE as follows:

HE = TD x GPM x 500, where HE = Heat of Extraction (Btuh); TD = temperature difference (EWT - LWT) and GPM = U.S. Gallons per Minute.

TD = HE / (GPM x 500)

TD = 22,500 / (4.5 x 500)

TD = 10°F

LWT = EWT - TD

LWT = 50 - 10 = 40°F

In this example, a higher flow rate will be required for EWTs at or below 50°F without antifreeze. At 2 gpm/ton, the calculation above results in a TD of 7.5. LWT = 50 - 7.5 = 42.5°F, which is above 42°F EWT, and is acceptable for this application.

Performance Data TRM-09

405 CFM Nominal (Rated) Airflow

Performance capacities shown in thousands of Btuh

*WPD Adder for Motorized Valve, TRM09 (Cv = 4.9, MOPD = 125 psi)		
GPM	WPD Adder	
	PSI	FT
1.10	0.25	0.58
1.70	0.64	1.48
2.25	1.27	2.93

EWT °F	GPM	WPD*		Cooling - EAT 80/67°F						Heating - EAT 70°F				
		PSI	FT	TC	SC	Sens/Tot Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	2.25	3.5	8.2	Operation Not Recommended						5.6	0.65	3.4	82.9	2.53
30	1.10	0.6	1.3	11.1	7.2	0.65	0.43	12.6	25.8	6.5	0.67	4.2	84.8	2.83
	1.70	1.7	4.0	11.2	7.3	0.65	0.41	12.6	27.6	6.8	0.68	4.5	85.6	2.95
	2.25	3.3	7.6	11.3	7.3	0.64	0.40	12.6	28.4	7.0	0.68	4.7	86.0	3.01
40	1.10	0.5	1.2	10.9	7.2	0.66	0.47	12.5	23.1	7.7	0.69	5.4	87.7	3.26
	1.70	1.6	3.7	11.1	7.2	0.65	0.44	12.5	25.1	8.2	0.70	5.8	88.7	3.42
	2.25	3.1	7.2	11.1	7.2	0.65	0.43	12.6	26.1	8.4	0.71	6.1	89.3	3.51
50	1.10	0.5	1.2	10.6	7.1	0.67	0.52	12.3	20.2	9.0	0.71	6.6	90.7	3.70
	1.70	1.5	3.5	10.8	7.2	0.66	0.49	12.4	22.3	9.6	0.72	7.1	91.9	3.89
	2.25	2.9	6.8	10.9	7.2	0.66	0.47	12.5	23.3	9.9	0.73	7.4	92.7	3.99
60	1.10	0.5	1.1	10.1	7.0	0.69	0.58	12.1	17.4	10.3	0.73	7.9	93.6	4.13
	1.70	1.4	3.3	10.5	7.1	0.68	0.54	12.3	19.4	11.0	0.74	8.5	95.2	4.35
	2.25	2.8	6.4	10.6	7.1	0.67	0.52	12.3	20.4	11.4	0.75	8.8	96.0	4.47
70	1.10	0.5	1.1	9.6	6.9	0.71	0.65	11.8	14.8	11.6	0.75	9.1	96.6	4.55
	1.70	1.4	3.2	10.0	7.0	0.70	0.60	12.0	16.6	12.4	0.76	9.8	98.3	4.78
	2.25	2.7	6.1	10.2	7.0	0.69	0.58	12.1	17.6	12.8	0.76	10.2	99.2	4.91
80	1.10	0.5	1.0	9.0	6.6	0.74	0.72	11.4	12.4	12.9	0.76	10.3	99.4	4.94
	1.70	1.3	3.1	9.4	6.8	0.72	0.67	11.7	14.0	13.7	0.77	11.0	101.2	5.18
	2.25	2.6	5.9	9.6	6.9	0.71	0.65	11.8	14.9	14.1	0.78	11.4	102.2	5.30
85	1.10	0.5	1.0	8.6	6.5	0.75	0.76	11.2	11.4	13.5	0.77	10.9	100.8	5.12
	1.70	1.3	3.1	9.1	6.7	0.74	0.71	11.5	12.9	14.3	0.78	11.6	102.6	5.35
	2.25	2.6	5.9	9.3	6.8	0.73	0.69	11.6	13.7	14.7	0.79	12.0	103.5	5.46
90	1.10	0.4	1.0	8.2	6.3	0.76	0.80	10.9	10.3	14.0	0.78	11.4	102.1	5.29
	1.70	1.3	3.0	8.7	6.5	0.75	0.75	11.3	11.7	14.8	0.79	12.1	103.9	5.51
	2.25	2.5	5.8	9.0	6.6	0.74	0.72	11.4	12.4	15.2	0.79	12.5	104.8	5.62
100	1.10	0.4	1.0	7.3	5.8	0.79	0.88	10.3	8.3	Operation Not Recommended				
	1.70	1.3	2.9	7.9	6.1	0.78	0.83	10.7	9.5					
	2.25	2.5	5.7	8.2	6.3	0.77	0.80	10.9	10.2					
110	1.10	0.4	0.9	6.3	5.2	0.83	0.96	9.6	6.6					
	1.70	1.3	2.9	6.9	5.6	0.81	0.91	10.0	7.6					
	2.25	2.4	5.6	7.2	5.8	0.80	0.89	10.3	8.2					
120	1.10	0.4	0.9	5.2	4.5	0.86	1.04	8.8	5.0					
	1.70	1.3	2.9	5.8	4.9	0.84	1.00	9.2	5.9					
	2.25	2.4	5.6	6.2	5.1	0.83	0.97	9.5	6.3					

Interpolation is permissible; extrapolation is not.
All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating. ARI/ISO certified conditions are 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.
Table does not reflect fan or pump power corrections for ARI/ISO conditions.
All performance is based upon the lower voltage of dual voltage rated units.
Operation below 60°F EWT requires optional insulated water/refrigerant circuit.
See performance correction tables for operating conditions other than those listed above.
See Performance Data Selection Notes for operation in the shaded area.

Performance Data TRM-12

445 CFM Nominal (Rated) Airflow

Performance capacities shown in thousands of Btuh

*WPD Adder for Motorized Valve, TRM12 (Cv = 4.9, MOPD = 125 psi)		
GPM	WPD Adder	
	PSI	FT
1.5	0.46	1.06
2.3	1.17	2.70
3.0	2.16	4.99

EWT °F	GPM	WPD*		Cooling - EAT 80/67°F						Heating - EAT 70°F				
		PSI	FT	TC	SC	Sens/Tot Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	3.0	6.2	14.3	Operation Not Recommended						7.7	0.83	4.9	85.9	2.70
30	1.5	1.4	3.2	15.1	9.4	0.62	0.53	16.8	28.5	8.6	0.86	5.8	88.0	2.96
	2.3	3.2	7.3	15.2	9.4	0.62	0.49	16.8	31.0	9.1	0.87	6.1	88.8	3.07
	3.0	5.8	13.4	15.2	9.4	0.62	0.47	16.8	32.2	9.3	0.87	6.4	89.3	3.13
40	1.5	1.2	2.8	14.7	9.2	0.63	0.59	16.7	24.8	10.2	0.89	7.2	91.2	3.35
	2.3	2.9	6.6	15.0	9.4	0.62	0.55	16.8	27.5	10.7	0.90	7.7	92.3	3.49
	3.0	5.3	12.1	15.1	9.4	0.62	0.52	16.8	28.8	11.0	0.91	8.0	93.0	3.56
50	1.5	1.2	2.7	14.1	9.0	0.64	0.66	16.4	21.3	11.8	0.92	8.7	94.5	3.74
	2.3	2.8	6.4	14.6	9.2	0.63	0.61	16.6	23.8	12.4	0.94	9.3	95.9	3.90
	3.0	5.1	11.8	14.8	9.3	0.63	0.59	16.7	25.2	12.8	0.94	9.6	96.7	3.98
60	1.5	1.1	2.6	13.4	8.7	0.65	0.74	15.9	18.1	13.4	0.95	10.1	97.8	4.11
	2.3	2.6	6.1	13.9	8.9	0.64	0.69	16.2	20.3	14.2	0.97	10.9	99.5	4.29
	3.0	4.8	11.2	14.2	9.0	0.64	0.66	16.4	21.6	14.6	0.98	11.3	100.4	4.38
70	1.5	1.1	2.4	12.6	8.3	0.66	0.83	15.4	15.2	15.0	0.98	11.6	101.1	4.46
	2.3	2.5	5.7	13.2	8.6	0.65	0.77	15.8	17.1	15.8	1.00	12.4	102.9	4.64
	3.0	4.6	10.7	13.4	8.7	0.65	0.74	15.9	18.2	16.3	1.01	12.9	103.9	4.74
80	1.5	1.0	2.3	11.6	7.9	0.68	0.91	14.7	12.7	16.5	1.01	13.1	104.3	4.78
	2.3	2.3	5.4	12.3	8.2	0.67	0.85	15.2	14.3	17.4	1.03	13.9	106.2	4.96
	3.0	4.4	10.1	12.6	8.3	0.66	0.82	15.4	15.2	17.9	1.04	14.3	107.2	5.06
85	1.5	1.0	2.2	11.1	7.7	0.69	0.96	14.4	11.6	17.2	1.02	13.7	105.8	4.92
	2.3	2.3	5.3	11.8	8.0	0.68	0.90	14.8	13.1	18.1	1.04	14.6	107.7	5.10
	3.0	4.3	9.9	12.1	8.1	0.67	0.87	15.0	13.9	18.6	1.05	15.0	108.6	5.19
90	1.5	0.9	2.1	10.6	7.5	0.71	1.01	14.0	10.6	17.9	1.04	14.4	107.3	5.06
	2.3	2.2	5.2	11.3	7.8	0.69	0.95	14.5	11.9	18.8	1.05	15.2	109.1	5.23
	3.0	4.2	9.7	11.6	7.9	0.68	0.92	14.7	12.6	19.2	1.06	15.6	110.1	5.32
100	1.5	0.9	2.1	9.6	7.1	0.74	1.10	13.3	8.7	Operation Not Recommended				
	2.3	2.2	5.1	10.2	7.3	0.72	1.04	13.8	9.8					
	3.0	4.2	9.6	10.5	7.5	0.71	1.01	14.0	10.4					
110	1.5	0.9	2.0	8.5	6.6	0.77	1.20	12.6	7.1					
	2.3	2.1	4.9	9.1	6.9	0.75	1.14	13.0	8.0					
	3.0	4.0	9.3	9.4	7.0	0.74	1.11	13.2	8.5					
120	1.5	0.9	2.0	7.4	6.1	0.82	1.30	11.9	5.7					
	2.3	2.1	4.8	8.0	6.4	0.79	1.24	12.3	6.4					
	3.0	4.0	9.2	8.3	6.5	0.78	1.22	12.5	6.8					

Interpolation is permissible; extrapolation is not.
All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating. ARI/ISO certified conditions are 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.
Table does not reflect fan or pump power corrections for ARI/ISO conditions.
All performance is based upon the lower voltage of dual voltage rated units.
Operation below 60°F EWT requires optional insulated water/refrigerant circuit.
See performance correction tables for operating conditions other than those listed above.
See Performance Data Selection Notes for operation in the shaded area.

Performance Data TRM-15

595 CFM Nominal (Rated) Airflow

Performance capacities shown in thousands of Btuh

*WPD Adder for Motorized Valve, TRM15 (Cv = 4.9, MOPD = 125 psi)		
GPM	WPD Adder	
	PSI	FT
1.9	0.74	1.71
2.8	1.74	4.02
3.8	2.16	4.99

EWT °F	GPM	WPD*		Cooling - EAT 80/67°F						Heating - EAT 70°F				
		PSI	FT	TC	SC	Sens/Tot Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	3.8	2.1	4.8	Operation Not Recommended						9.3	0.99	5.9	84.4	2.8
30	1.9	0.3	0.8	19.0	12.1	0.64	0.64	21.2	29.5	10.4	1.01	7.0	86.3	3.0
	2.8	0.6	1.4	19.5	12.1	0.62	0.60	21.5	32.5	10.9	1.02	7.5	87.0	3.1
	3.8	1.8	4.2	19.7	12.0	0.61	0.58	21.6	34.0	11.2	1.03	7.7	87.4	3.2
40	1.9	0.3	0.7	18.2	11.9	0.65	0.72	20.6	25.5	12.3	1.05	8.7	89.1	3.4
	2.8	0.5	1.2	18.8	12.1	0.64	0.66	21.0	28.4	12.9	1.06	9.3	90.1	3.6
	3.8	1.6	3.8	19.1	12.1	0.63	0.64	21.2	30.0	13.3	1.06	9.7	90.6	3.7
50	1.9	0.3	0.6	17.3	11.5	0.67	0.80	20.0	21.6	14.2	1.08	10.5	92.1	3.9
	2.8	0.5	1.2	18.0	11.8	0.66	0.74	20.4	24.3	15.0	1.09	11.3	93.3	4.0
	3.8	1.5	3.5	18.3	11.9	0.65	0.71	20.7	25.8	15.4	1.10	11.7	94.0	4.1
60	1.9	0.3	0.6	16.2	11.1	0.68	0.89	19.2	18.2	16.1	1.11	12.4	95.1	4.3
	2.8	0.5	1.1	17.0	11.4	0.67	0.83	19.8	20.5	17.1	1.13	13.2	96.5	4.4
	3.8	1.4	3.3	17.4	11.6	0.67	0.79	20.0	21.8	17.6	1.13	13.7	97.4	4.6
70	1.9	0.2	0.5	15.1	10.5	0.70	0.99	18.4	15.2	18.1	1.14	14.2	98.1	4.7
	2.8	0.4	1.0	15.9	10.9	0.69	0.93	19.0	17.1	19.2	1.16	15.2	99.8	4.9
	3.8	1.3	3.0	16.2	11.1	0.68	0.89	19.2	18.2	19.8	1.17	15.8	100.7	5.0
80	1.9	0.2	0.5	13.8	10.0	0.72	1.10	17.6	12.6	20.0	1.17	16.1	101.2	5.0
	2.8	0.4	1.0	14.6	10.3	0.71	1.03	18.1	14.2	21.2	1.19	17.2	103.1	5.2
	3.8	1.3	2.9	15.0	10.5	0.70	1.00	18.4	15.1	21.9	1.20	17.8	104.1	5.3
85	1.9	0.2	0.5	13.2	9.7	0.73	1.16	17.1	11.5	21.0	1.19	17.0	102.7	5.2
	2.8	0.4	1.0	14.0	10.0	0.72	1.09	17.7	12.9	22.3	1.21	18.1	104.6	5.4
	3.8	1.2	2.8	14.4	10.2	0.71	1.05	18.0	13.7	22.9	1.22	18.8	105.7	5.5
90	1.9	0.2	0.5	12.6	9.4	0.75	1.22	16.7	10.3	22.0	1.20	17.9	104.2	5.4
	2.8	0.4	0.9	13.3	9.7	0.73	1.15	17.2	11.6	23.3	1.23	19.1	106.2	5.6
	3.8	1.2	2.8	13.7	9.9	0.72	1.11	17.5	12.4	24.0	1.24	19.7	107.3	5.7
100	1.9	0.2	0.5	11.3	8.9	0.79	1.33	15.8	8.5	Operation Not Recommended				
	2.8	0.4	0.9	12.0	9.2	0.76	1.27	16.3	9.5					
	3.8	1.2	2.7	12.4	9.3	0.75	1.23	16.6	10.1					
110	1.9	0.2	0.5	10.0	8.4	0.84	1.46	15.0	6.9					
	2.8	0.4	0.8	10.7	8.6	0.81	1.39	15.4	7.7					
	3.8	1.1	2.5	11.0	8.8	0.80	1.35	15.7	8.2					
120	1.9	0.2	0.4	8.7	7.9	0.91	1.58	14.1	5.5					
	2.8	0.4	0.8	9.4	8.1	0.87	1.52	14.5	6.2					
	3.8	1.1	2.4	9.7	8.3	0.85	1.48	14.8	6.5					

Interpolation is permissible; extrapolation is not.
All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating. ARI/ISO certified conditions are 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.
Table does not reflect fan or pump power corrections for ARI/ISO conditions.
All performance is based upon the lower voltage of dual voltage rated units.
Operation below 60°F EWT requires optional insulated water/refrigerant circuit.
See performance correction tables for operating conditions other than those listed above.
See Performance Data Selection Notes for operation in the shaded area.

Performance Data TRM-18

685 CFM Nominal (Rated) Airflow

Performance capacities shown in thousands of Btuh

*WPD Adder for Motorized Valve, TRM18 (Cv = 10.3, MOPD = 125 psi)		
GPM	WPD Adder	
	PSI	FT
2.3	0.24	0.55
3.4	0.58	1.34
4.5	1.10	2.54

EWT °F	GPM	WPD*		Cooling - EAT 80/67°F						Heating - EAT 70°F				
		PSI	FT	TC	SC	Sens/Tot Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	4.5	3.8	8.8	Operation Not Recommended						11.6	1.19	7.6	85.7	2.82
30	2.3	0.7	1.5	21.9	14.8	0.67	0.77	24.5	28.3	12.7	1.21	8.6	87.2	3.05
	3.4	1.8	4.3	22.2	14.8	0.67	0.73	24.6	30.6	13.2	1.21	9.1	87.9	3.15
	4.5	3.5	8.0	22.3	14.8	0.66	0.71	24.6	31.5	13.5	1.22	9.4	88.3	3.20
40	2.3	0.6	1.3	21.3	14.6	0.68	0.86	24.1	24.9	14.7	1.23	10.4	89.8	3.43
	3.4	1.7	3.9	21.8	14.7	0.68	0.79	24.4	27.4	15.3	1.24	11.1	90.7	3.56
	4.5	3.2	7.3	22.0	14.8	0.67	0.77	24.5	28.6	15.7	1.24	11.5	91.3	3.64
50	2.3	0.6	1.3	20.4	14.2	0.70	0.96	23.6	21.3	16.8	1.26	12.5	92.7	3.84
	3.4	1.6	3.6	21.0	14.5	0.69	0.88	24.0	23.8	17.6	1.27	13.3	93.8	4.01
	4.5	2.9	6.8	21.3	14.6	0.68	0.85	24.1	25.1	18.1	1.27	13.7	94.5	4.10
60	2.3	0.5	1.1	19.3	13.7	0.71	1.07	22.9	18.1	19.0	1.28	14.6	95.6	4.25
	3.4	1.4	3.3	20.1	14.0	0.70	0.99	23.4	20.3	20.0	1.30	15.6	97.1	4.45
	4.5	2.7	6.3	20.4	14.2	0.69	0.95	23.6	21.5	20.6	1.30	16.1	97.8	4.55
70	2.3	0.5	1.1	18.2	13.1	0.72	1.20	22.2	15.2	21.2	1.31	16.7	98.7	4.66
	3.4	1.3	3.0	19.0	13.5	0.71	1.11	22.7	17.0	22.4	1.32	17.8	100.3	4.87
	4.5	2.5	5.8	19.4	13.7	0.71	1.07	22.9	18.1	23.0	1.33	18.4	101.1	4.98
80	2.3	0.5	1.1	16.9	12.5	0.74	1.34	21.4	12.6	23.4	1.34	18.8	101.6	5.05
	3.4	1.3	3.0	17.7	12.9	0.73	1.25	21.9	14.2	24.6	1.35	20.0	103.3	5.27
	4.5	2.4	5.5	18.1	13.1	0.72	1.20	22.2	15.1	25.3	1.35	20.6	104.2	5.38
85	2.3	0.4	1.0	16.2	12.2	0.75	1.41	21.0	11.5	24.4	1.35	19.8	103.0	5.23
	3.4	1.2	2.7	17.0	12.6	0.74	1.32	21.5	13.0	25.6	1.36	21.0	104.7	5.44
	4.5	2.3	5.3	17.4	12.8	0.73	1.27	21.7	13.8	26.3	1.36	21.6	105.5	5.56
90	2.3	0.4	0.9	15.5	11.9	0.77	1.48	20.5	10.5	25.4	1.36	20.8	104.4	5.41
	3.4	1.2	2.7	16.3	12.3	0.75	1.39	21.1	11.8	26.7	1.37	21.9	106.0	5.62
	4.5	2.3	5.2	16.8	12.5	0.74	1.34	21.3	12.5	27.3	1.37	22.5	106.9	5.73
100	2.3	0.4	0.9	14.1	11.2	0.80	1.63	19.7	8.6	Operation Not Recommended				
	3.4	1.2	2.7	14.9	11.6	0.78	1.54	20.2	9.7					
	4.5	2.2	5.0	15.4	11.8	0.77	1.50	20.4	10.3					
110	2.3	0.4	0.9	12.7	10.6	0.83	1.79	18.8	7.1					
	3.4	1.1	2.6	13.5	11.0	0.81	1.70	19.3	8.0					
	4.5	2.1	4.9	13.9	11.2	0.80	1.65	19.6	8.4					
120	2.3	0.4	0.9	11.4	10.1	0.88	1.95	18.1	5.9					
	3.4	1.1	2.6	12.1	10.4	0.86	1.86	18.5	6.5					
	4.5	2.1	4.9	12.5	10.5	0.84	1.82	18.7	6.9					

Interpolation is permissible; extrapolation is not.
All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating. ARI/ISO certified conditions are 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.
Table does not reflect fan or pump power corrections for ARI/ISO conditions.
All performance is based upon the lower voltage of dual voltage rated units.
Operation below 60°F EWT requires optional insulated water/refrigerant circuit.
See performance correction tables for operating conditions other than those listed above.
See Performance Data Selection Notes for operation in the shaded area.

Performance Data TRM-24

850 CFM Nominal (Rated) Airflow

Performance capacities shown in thousands of Btuh

*WPD Adder for Motorized Valve, TRM24 (Cv = 10.3, MOPD = 125 psi)		
GPM	WPD Adder	
	PSI	FT
3.0	0.42	0.97
4.5	1.02	2.36
6.0	1.96	4.53

EWT °F	GPM	WPD*		Cooling - EAT 80/67°F						Heating - EAT 70°F				
		PSI	FT	TC	SC	Sens/Tot Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	6.0	5.7	13.2	Operation Not Recommended						14.1	1.58	8.8	85.3	2.61
30	3.0	1.3	3.1	28.4	19.6	0.69	1.06	31.9	26.7	15.9	1.59	10.6	87.3	2.93
	4.5	2.4	5.4	27.9	18.8	0.67	1.00	31.1	28.0	16.6	1.60	11.2	88.1	3.04
	6.0	4.6	10.5	27.4	18.2	0.67	0.97	30.6	28.4	17.0	1.60	11.6	88.5	3.11
40	3.0	1.2	2.8	28.4	20.0	0.71	1.17	32.2	24.3	18.7	1.62	13.3	90.4	3.38
	4.5	2.2	5.1	28.5	19.8	0.69	1.09	32.1	26.0	19.7	1.64	14.1	91.4	3.52
	6.0	4.3	9.8	28.4	19.5	0.69	1.06	31.9	26.8	20.2	1.65	14.6	92.0	3.59
50	3.0	1.2	2.7	27.6	19.8	0.72	1.29	31.9	21.4	21.7	1.67	16.1	93.6	3.80
	4.5	2.1	4.6	28.2	20.0	0.71	1.20	32.2	23.4	22.9	1.69	17.2	94.9	3.96
	6.0	4.1	9.4	28.4	20.0	0.70	1.16	32.2	24.4	23.6	1.71	17.8	95.7	4.04
60	3.0	1.1	2.5	26.3	19.2	0.73	1.43	31.1	18.5	24.8	1.73	19.0	97.0	4.19
	4.5	1.9	4.3	27.2	19.7	0.72	1.33	31.7	20.5	26.3	1.77	20.3	98.6	4.36
	6.0	3.7	8.5	27.6	19.8	0.72	1.28	31.9	21.6	27.1	1.78	21.0	99.5	4.45
70	3.0	1.1	2.4	24.7	18.4	0.75	1.58	30.0	15.6	28.0	1.81	21.9	100.5	4.54
	4.5	1.8	4.2	25.8	19.0	0.74	1.48	30.8	17.5	29.7	1.85	23.4	102.3	4.71
	6.0	3.6	8.3	26.4	19.2	0.73	1.42	31.1	18.5	30.6	1.87	24.3	103.4	4.80
80	3.0	1.0	2.3	22.8	17.5	0.77	1.77	28.8	12.9	31.2	1.88	24.8	104.0	4.85
	4.5	1.7	3.9	24.1	18.1	0.75	1.65	29.6	14.6	33.1	1.93	26.5	106.0	5.01
	6.0	3.3	7.7	24.7	18.4	0.75	1.59	30.0	15.5	34.1	1.96	27.5	107.2	5.10
85	3.0	1.0	2.2	21.8	17.0	0.78	1.88	28.2	11.7	32.8	1.93	26.2	105.7	4.98
	4.5	1.6	3.8	23.1	17.6	0.76	1.75	29.0	13.3	34.7	1.98	28.0	107.8	5.14
	6.0	3.3	7.6	23.7	17.9	0.76	1.68	29.4	14.2	35.8	2.01	29.0	109.0	5.22
90	3.0	1.0	2.2	20.8	16.5	0.79	1.99	27.6	10.5	34.3	1.97	27.7	107.4	5.11
	4.5	1.6	3.7	22.1	17.1	0.77	1.85	28.3	12.0	36.4	2.03	29.5	109.7	5.27
	6.0	3.3	7.5	22.7	17.4	0.77	1.78	28.7	12.8	37.5	2.06	30.5	110.9	5.35
100	3.0	0.9	2.1	18.8	15.6	0.83	2.24	26.4	8.4	Operation Not Recommended				
	4.5	1.6	3.6	20.0	16.2	0.81	2.08	27.1	9.6					
	6.0	3.0	6.9	20.6	16.4	0.80	2.01	27.5	10.3					
110	3.0	0.9	2.0	16.9	14.9	0.88	2.53	25.6	6.7					
	4.5	1.5	3.5	18.0	15.3	0.85	2.36	26.0	7.6					
	6.0	3.0	6.9	18.6	15.5	0.84	2.27	26.3	8.2					
120	3.0	0.9	2.0	15.2	14.4	0.95	2.88	25.1	5.3					
	4.5	1.5	3.5	16.1	14.6	0.91	2.68	25.3	6.0					
	6.0	3.0	6.8	16.6	14.8	0.89	2.59	25.4	6.4					

Interpolation is permissible; extrapolation is not.
All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating. ARI/ISO certified conditions are 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.
Table does not reflect fan or pump power corrections for ARI/ISO conditions.
All performance is based upon the lower voltage of dual voltage rated units.
Operation below 60°F EWT requires optional insulated water/refrigerant circuit.
See performance correction tables for operating conditions other than those listed above.
See Performance Data Selection Notes for operation in the shaded area.

Performance Data TRM-30

*WPD Adder for Motorized Valve, TRM30 (Cv = 10.3, MOPD = 125 psi)	
GPM	WPD Adder
	PSI / FT
3.8	0.67 / 1.55
5.6	1.58 / 3.65
7.5	3.06 / 7.07

1140 CFM Nominal (Rated) Airflow

Performance capacities shown in thousands of Btuh

EWT °F	GPM	WPD*		Cooling - EAT 80/67°F						Heating - EAT 70°F				
		PSI	FT	TC	SC	Sens/Tot Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	7.5	5.6	13.0	Operation Not Recommended						16.8	1.82	10.8	83.7	2.71
30	3.8	1.0	2.2	32.8	20.8	0.63	1.34	35.5	23.1	19.1	1.85	12.9	85.5	3.03
	5.6	2.9	6.8	32.1	20.6	0.64	1.28	34.6	23.8	19.9	1.86	13.7	86.2	3.15
	7.5	5.5	12.7	31.7	20.5	0.65	1.24	34.1	24.1	20.4	1.86	14.1	86.6	3.21
40	3.8	0.9	2.1	33.3	20.9	0.63	1.46	36.3	21.6	22.4	1.89	16.1	88.2	3.49
	5.6	2.9	6.6	33.0	20.8	0.63	1.38	35.9	22.6	23.5	1.90	17.1	89.1	3.62
	7.5	5.4	12.5	32.8	20.8	0.63	1.35	35.5	23.0	24.1	1.91	17.6	89.5	3.70
50	3.8	0.9	2.1	33.1	21.1	0.64	1.58	36.6	19.8	25.8	1.93	19.3	90.9	3.92
	5.6	2.8	6.5	33.3	21.0	0.63	1.50	36.5	21.0	27.0	1.94	20.4	91.9	4.07
	7.5	5.3	12.2	33.3	20.9	0.63	1.46	36.4	21.5	27.6	1.95	21.1	92.4	4.15
60	3.8	0.8	1.8	32.4	21.0	0.65	1.72	36.5	17.8	29.0	1.97	22.3	93.5	4.31
	5.6	2.4	5.6	32.9	21.1	0.64	1.63	36.6	19.1	30.2	1.99	23.5	94.6	4.46
	7.5	4.5	10.5	33.1	21.1	0.64	1.59	36.6	19.8	30.9	1.99	24.2	95.1	4.54
70	3.8	0.8	1.8	31.3	20.8	0.67	1.89	35.9	15.7	31.8	2.01	25.0	95.9	4.65
	5.6	2.4	5.4	32.1	21.0	0.65	1.78	36.3	17.0	33.0	2.02	26.2	96.8	4.78
	7.5	4.4	10.2	32.4	21.0	0.65	1.73	36.5	17.7	33.6	2.03	26.7	97.3	4.85
80	3.8	0.7	1.5	29.6	20.3	0.69	2.08	35.1	13.4	34.2	2.04	27.3	97.8	4.91
	5.6	2.0	4.7	30.7	20.7	0.67	1.96	35.7	14.8	35.1	2.05	28.1	98.5	5.01
	7.5	3.8	8.9	31.2	20.8	0.67	1.90	35.9	15.5	35.4	2.06	28.5	98.8	5.04
85	3.8	0.6	1.4	28.6	19.9	0.70	2.20	34.5	12.4	34.9	2.05	28.0	98.4	4.99
	5.6	2.0	4.6	29.8	20.3	0.68	2.06	35.2	13.7	35.6	2.06	28.6	98.9	5.05
	7.5	3.7	8.6	30.3	20.5	0.68	2.00	35.4	14.4	35.8	2.07	28.8	99.1	5.07
90	3.8	0.6	1.4	27.6	19.4	0.71	2.31	33.9	11.3	35.7	2.06	28.7	99.0	5.07
	5.6	1.9	4.5	28.9	20.0	0.69	2.17	34.7	12.6	36.1	2.07	29.0	99.3	5.10
	7.5	3.6	8.4	29.5	20.2	0.69	2.10	35.0	13.3	36.1	2.07	29.1	99.3	5.10
100	3.8	0.6	1.4	25.1	18.2	0.72	2.58	32.5	9.2	Operation Not Recommended				
	5.6	1.9	4.3	26.6	19.0	0.71	2.42	33.4	10.4					
	7.5	3.5	8.1	27.3	19.3	0.71	2.34	33.8	11.0					
110	3.8	0.6	1.4	22.3	16.5	0.74	2.90	31.0	7.3					
	5.6	1.8	4.1	23.9	17.5	0.73	2.72	31.9	8.3					
	7.5	3.5	8.1	24.7	18.0	0.73	2.63	32.3	8.9					
120	3.8	0.6	1.4	19.1	14.4	0.75	3.26	29.2	5.5					
	5.6	1.8	4.1	20.8	15.6	0.75	3.06	30.2	6.4					
	7.5	3.4	7.8	21.7	16.1	0.74	2.96	30.6	6.9					

Interpolation is permissible; extrapolation is not.
All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating. ARI/ISO certified conditions are 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.
Table does not reflect fan or pump power corrections for ARI/ISO conditions.
All performance is based upon the lower voltage of dual voltage rated units.
Operation below 60°F EWT requires optional insulated water/refrigerant circuit.
See performance correction tables for operating conditions other than those listed above.
See Performance Data Selection Notes for operation in the shaded area.

Performance Data TRM-36

*WPD Adder for Motorized Valve, TRM36 (Cv = 10.3, MOPD = 125 psi)		
GPM	WPD Adder	
	PSI	FT
4.5	0.93	2.15
6.8	2.32	5.36
9.0	4.40	10.20

1260 CFM Nominal (Rated) Airflow

Performance capacities shown in thousands of Btuh

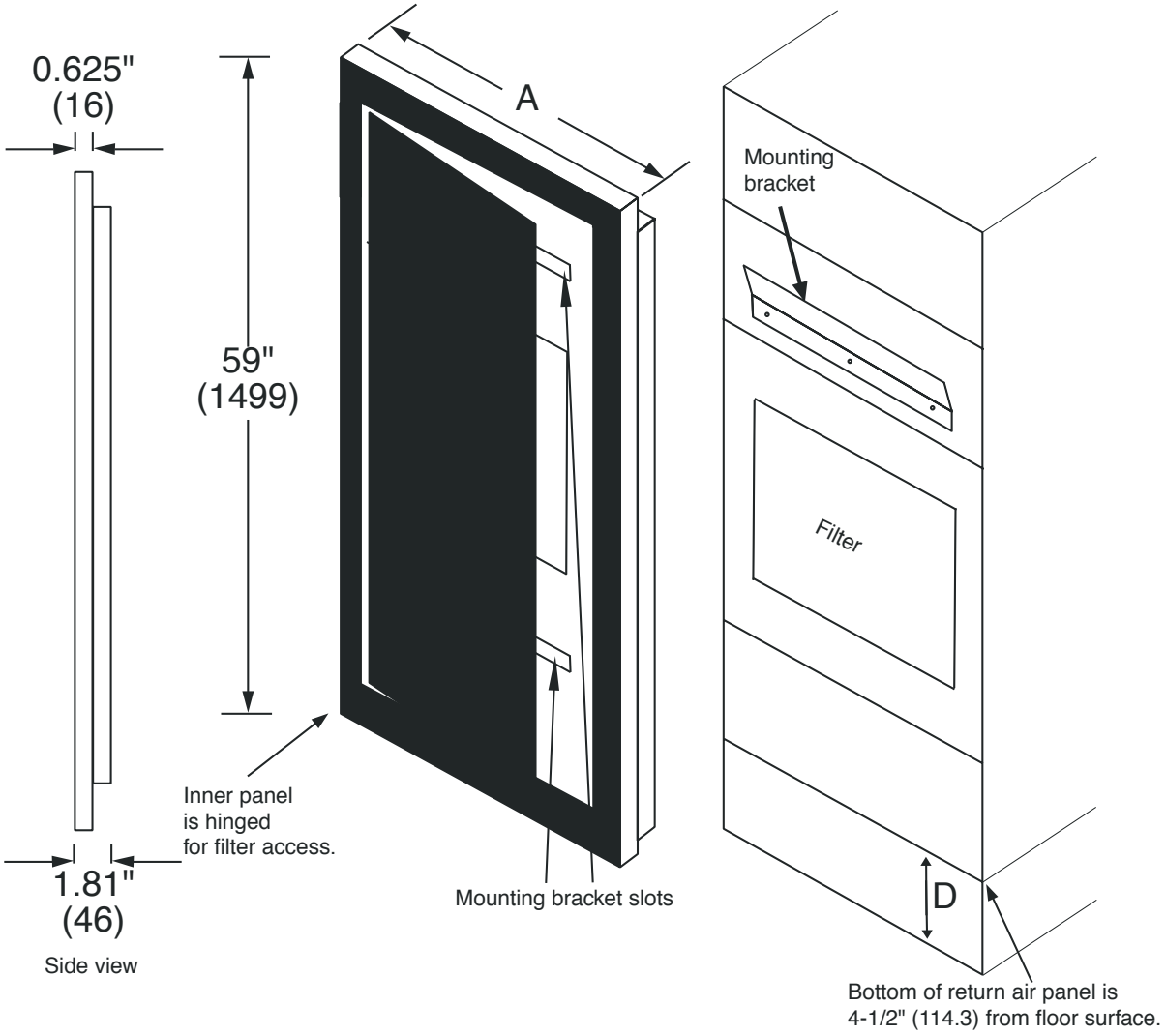
EWT °F	GPM	WPD*		Cooling - EAT 80/67°F						Heating - EAT 70°F				
		PSI	FT	TC	SC	Sens/Tot Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	9.0	9.8	22.7	Operation Not Recommended						20.6	2.16	13.3	85.1	2.78
30	4.5	2.5	5.8	39.9	25.1	0.63	1.56	45.1	25.5	23.0	2.20	15.6	86.9	3.06
	6.8	5.2	11.9	39.7	24.2	0.61	1.48	44.6	26.8	23.9	2.21	16.5	87.6	3.16
	9.0	8.6	19.9	39.4	23.5	0.60	1.44	44.1	27.3	24.4	2.22	17.0	87.9	3.22
40	4.5	2.4	5.4	39.6	25.6	0.65	1.70	45.2	23.2	26.7	2.26	19.2	89.6	3.47
	6.8	4.8	11.2	39.9	25.3	0.64	1.61	45.2	24.8	27.9	2.27	20.3	90.5	3.60
	9.0	8.1	18.7	39.9	25.1	0.63	1.57	45.1	25.5	28.5	2.28	20.9	91.0	3.67
50	4.5	2.1	4.9	38.5	25.4	0.66	1.86	44.7	20.7	30.6	2.31	22.8	92.5	3.88
	6.8	4.4	10.2	39.3	25.6	0.65	1.76	45.1	22.4	32.0	2.33	24.2	93.5	4.02
	9.0	7.4	17.0	39.5	25.6	0.65	1.71	45.2	23.2	32.8	2.34	24.9	94.1	4.10
60	4.5	2.0	4.6	36.9	24.8	0.67	2.05	43.8	18.0	34.5	2.37	26.5	95.3	4.27
	6.8	4.1	9.4	38.0	25.2	0.66	1.92	44.4	19.7	36.1	2.39	28.0	96.5	4.42
	9.0	6.8	15.7	38.5	25.4	0.66	1.87	44.7	20.6	37.0	2.41	28.9	97.2	4.50
70	4.5	1.9	4.5	34.9	23.8	0.68	2.26	42.5	15.5	38.3	2.43	30.1	98.2	4.62
	6.8	4.0	9.2	36.2	24.4	0.67	2.12	43.3	17.1	40.1	2.46	31.8	99.5	4.78
	9.0	6.6	15.3	36.8	24.7	0.67	2.05	43.7	17.9	41.1	2.48	32.7	100.2	4.86
80	4.5	1.8	4.1	32.7	22.8	0.70	2.51	41.2	13.1	42.0	2.49	33.6	100.9	4.94
	6.8	3.7	8.5	34.1	23.4	0.69	2.35	42.0	14.5	43.9	2.53	35.3	102.3	5.09
	9.0	6.2	14.2	34.8	23.7	0.68	2.27	42.4	15.3	44.9	2.55	36.2	103.0	5.16
85	4.5	1.8	4.0	31.6	22.2	0.70	2.65	40.5	12.0	43.8	2.53	35.2	102.2	5.07
	6.8	3.8	8.8	33.0	22.9	0.69	2.48	41.3	13.3	45.6	2.56	36.9	103.5	5.21
	9.0	6.0	13.9	33.6	23.2	0.69	2.40	41.8	14.1	46.5	2.58	37.8	104.2	5.28
90	4.5	1.7	4.0	30.4	21.7	0.71	2.79	39.9	10.9	45.5	2.56	36.8	103.4	5.21
	6.8	4.0	9.1	31.8	22.3	0.70	2.62	40.6	12.1	47.3	2.60	38.5	104.7	5.33
	9.0	5.9	13.6	32.5	22.6	0.70	2.53	41.1	12.8	48.2	2.62	39.3	105.4	5.39
100	4.5	1.7	3.8	28.0	20.8	0.74	3.13	38.7	8.9	Operation Not Recommended				
	6.8	3.4	7.9	29.4	21.3	0.73	2.93	39.3	10.0					
	9.0	5.7	13.2	30.1	21.6	0.72	2.84	39.7	10.6					
110	4.5	1.6	3.8	25.8	20.2	0.78	3.53	37.8	7.3					
	6.8	3.4	7.7	27.0	20.5	0.76	3.30	38.3	8.2					
	9.0	5.6	13.0	27.7	20.7	0.75	3.19	38.5	8.7					
120	4.5	1.6	3.7	23.8	20.0	0.84	4.00	37.4	5.9					
	6.8	3.3	7.7	24.8	20.1	0.81	3.73	37.6	6.7					
	9.0	5.6	12.9	25.4	20.1	0.79	3.61	37.7	7.1					

Interpolation is permissible; extrapolation is not.
All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating. ARI/ISO certified conditions are 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.
Table does not reflect fan or pump power corrections for ARI/ISO conditions.
All performance is based upon the lower voltage of dual voltage rated units.
Operation below 60°F EWT requires optional insulated water/refrigerant circuit.
See performance correction tables for operating conditions other than those listed above.
See Performance Data Selection Notes for operation in the shaded area.

Physical Data

Model	09	12	15	18	24	30	36
Compressor (1 Each)	Rotary				Scroll		
Factory Charge R410A (oz) [kg]	33.5 [0.95]	35 [0.99]	43 [1.22]	48.5 [1.38]	71 [2.01]	75 [2.13]	75 [2.13]
PSC Fan Motor & Blower (2 Speeds)							
Fan Motor (hp) [W]	1/30 [25]	1/15 [50]	1/6 [124]	1/6 [124]	1/5 [149]	1/2 [373]	1/2 [373]
Blower Wheel Size (dia x w) - (in) [mm]	6.75 x 7.25 [174 x 184]	6.75 x 7.25 [174 x 184]	9.50 x 7.12 [241 x 181]	9.50 x 7.12 [241 x 181]	9.50 x 7.12 [241 x 181]	9.50 x 8.06 [241 x 205]	9.50 x 8.06 [241 x 205]
Hose Kit (AHH Series Required)							
IPT (in)	1/2	1/2	3/4	3/4	1	1	1
Chassis Air Coil							
Air Coil Dimensions (h x w) - (in) [mm]	22 x 11.5 [559 x 292]	22 x 11.5 [559 x 292]	28 x 14 [711 x 356]	28 x 14 [711 x 356]	30 x 18 [762 x 457]	30 x 18 [762 x 457]	30 x 18 [762 x 457]
Standard Filter - 1" [25.4mm] Throwaway, qty (in) [mm]	14 x 24 [356 x 610]	14 x 24 [356 x 610]	16 x 30 [406 x 762]	16 x 30 [406 x 762]	20 x 32 [508 x 813]	20 x 32 [508 x 813]	20 x 32 [508 x 813]
Weight							
Chassis - (lbs) [kg]	90 [41]	97 [44]	115 [52]	115 [52]	176 [80]	182 [83]	182 [83]
Cabinet - (lbs) [kg]	174 [79]	174 [79]	189 [86]	189 [86]	243 [110]	243 [110]	243 [110]

Hinged Return Air Panel - "G" Style

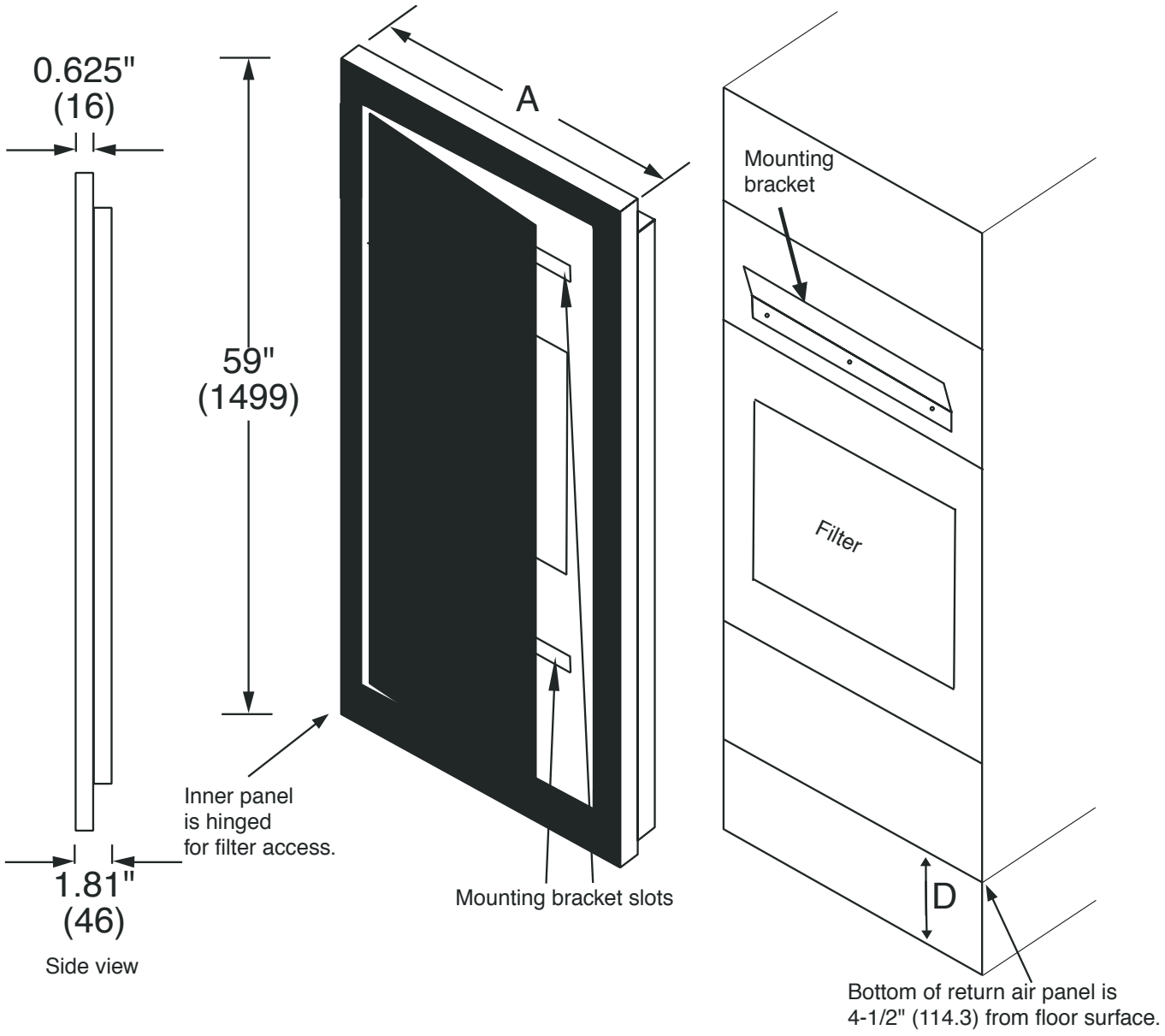


Unit Size	A
09 - 12	17-1/2" [445]
15 - 18	20-1/2" [521]
24 - 36	24-1/2" [622]

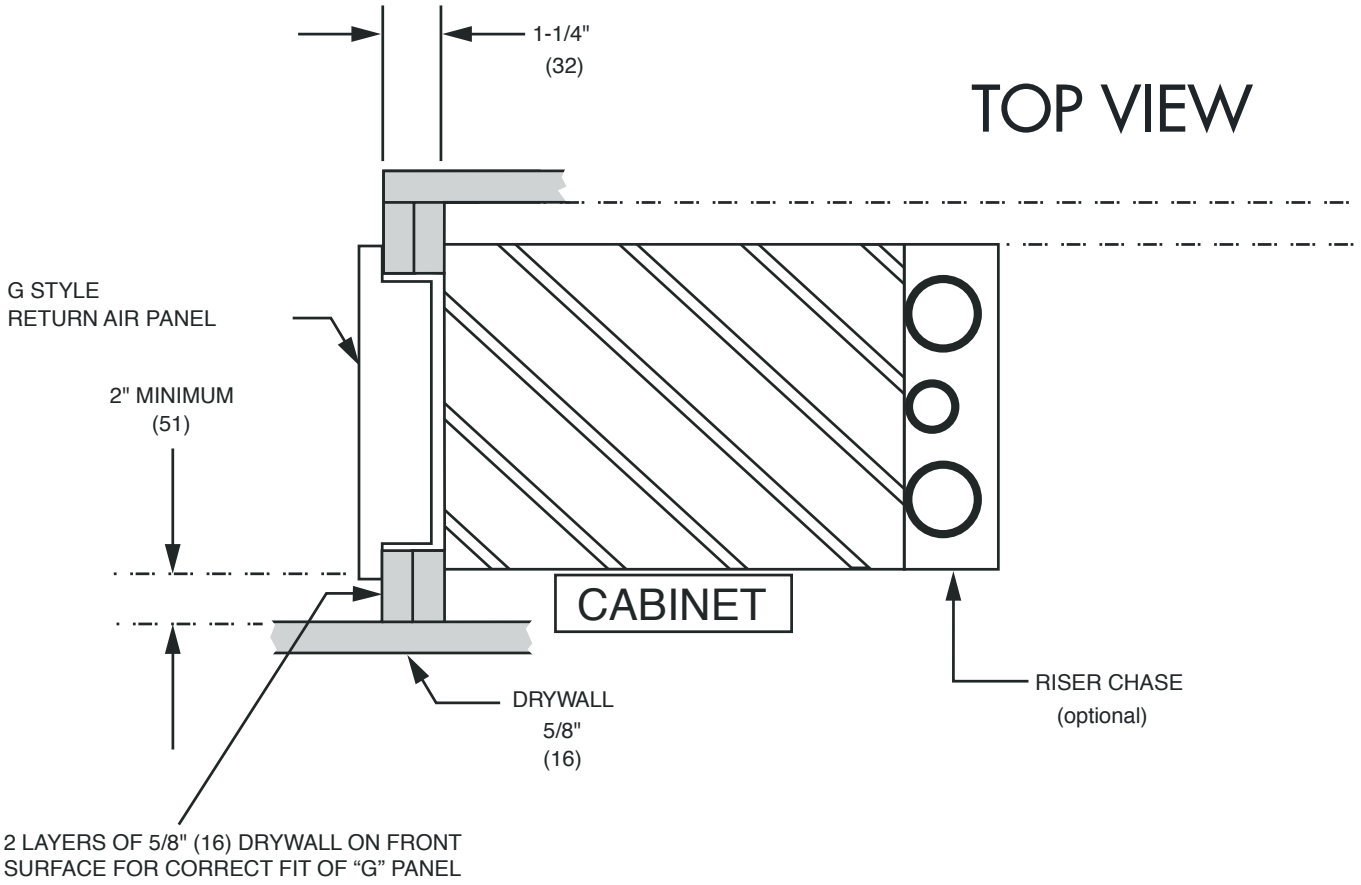
1.25" (32) drywall flanges must be used on cabinet.

Notes:
1. Panel Fits over mounting bracket for self alignment, then 4 bolts driven through panels slots into nuts on chassis.
2. Panel is painted Polar Ice White
3. All measurements are in inches, millimeters are in parenthesis.

Hinged Return Air Panel - "G" With Keyed Locks



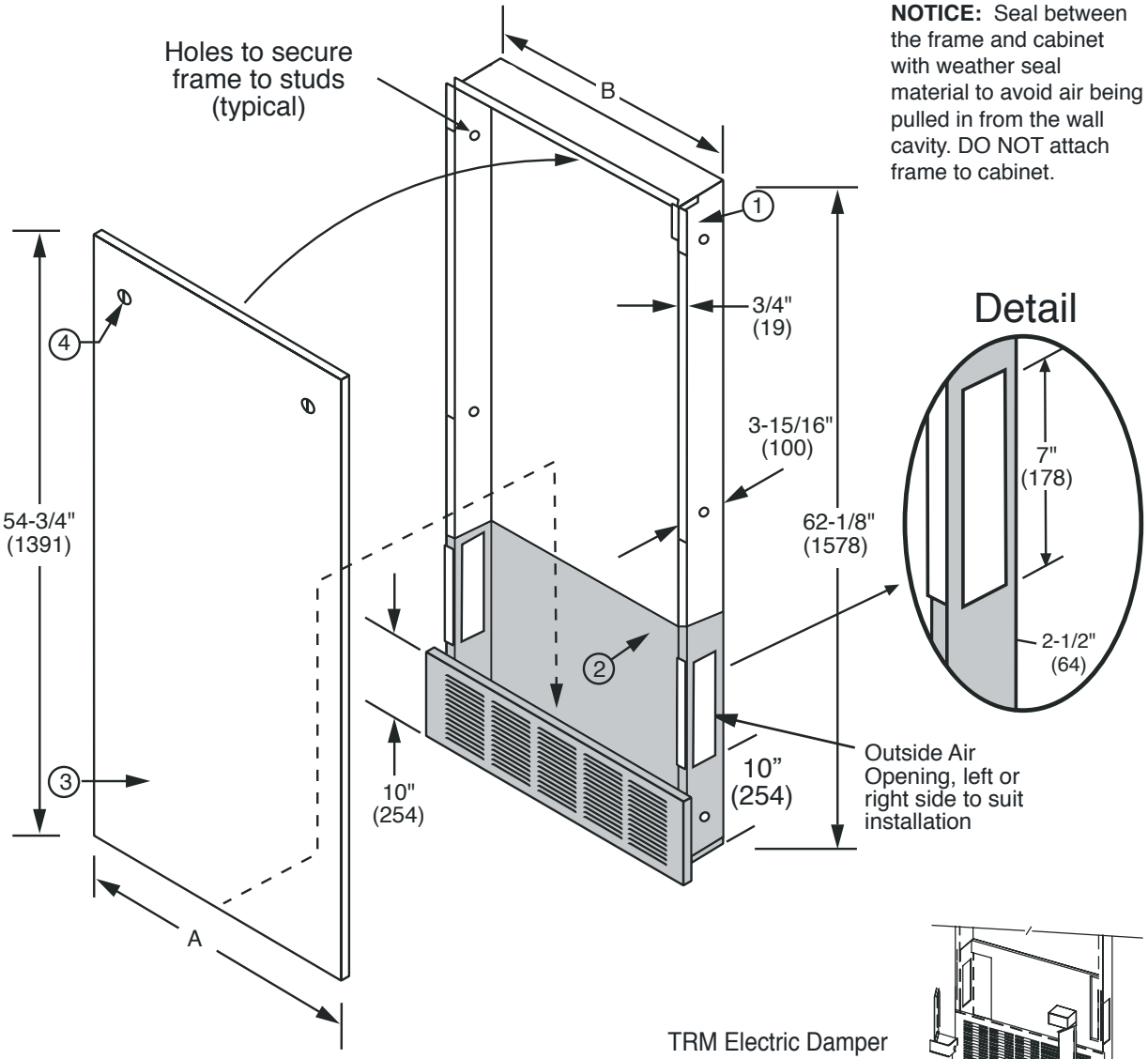
Hinged Return Air Panel - "G" Style Installation



Drywall can be applied directly to unit surfaces, however, for best sound attenuation, a furred in stud wall installation is recommended.

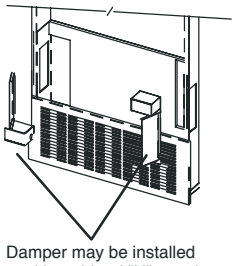
Note: All measurements are in inches, millimeters are in parenthesis.

Return Air Panel - "H" Style



NOTICE: Seal between the frame and cabinet with weather seal material to avoid air being pulled in from the wall cavity. DO NOT attach frame to cabinet.

TRM Electric Damper



Damper may be installed on either side of "H" panel

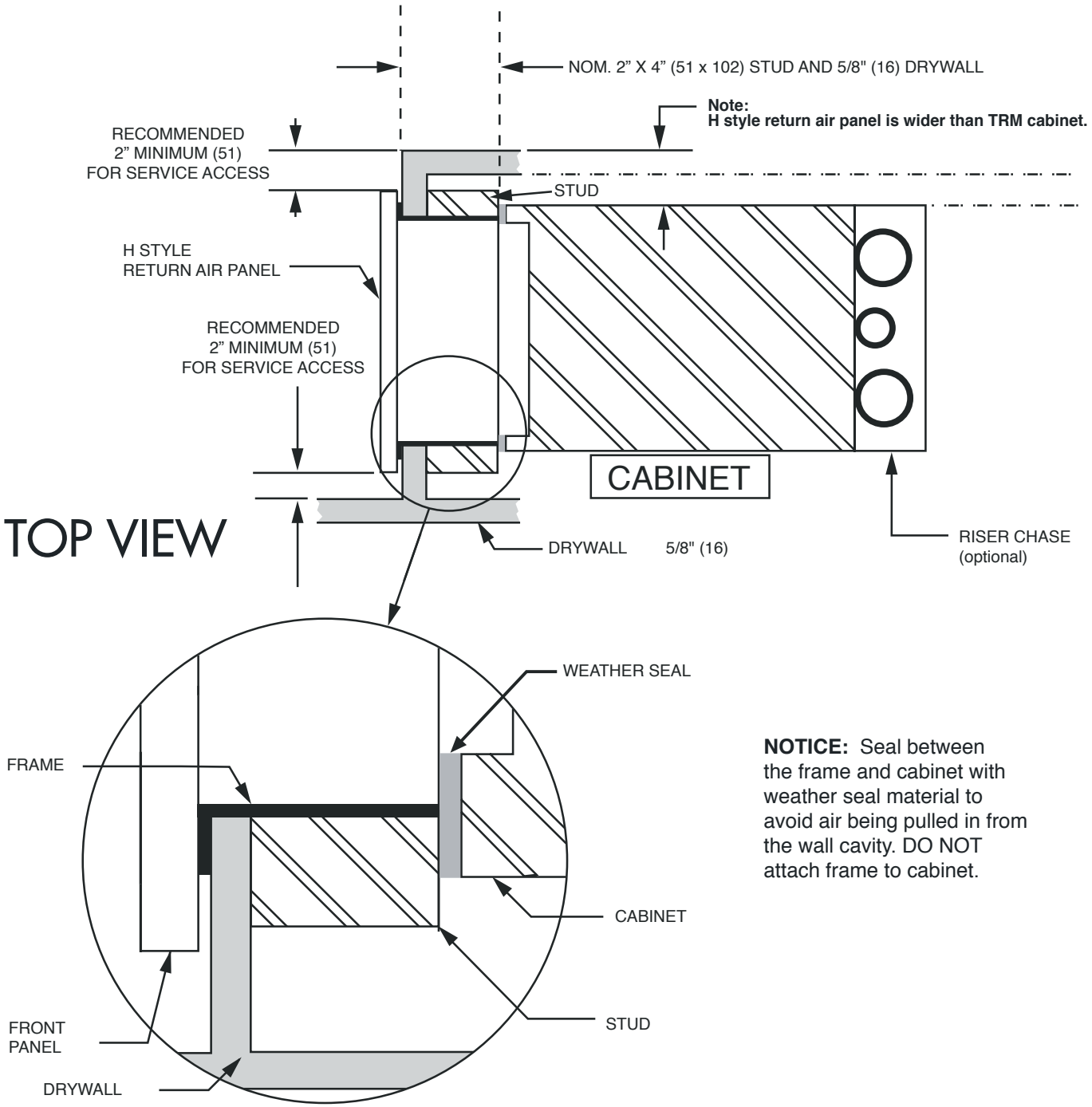
Notes: When outside air is used, contractor must supply outside air duct and cut hole in stud.

Item	QTY	Description
1	1	Frame assembly
2	1	Lower block-off assembly
3	1	Insulated front panel
4	2	1/4 turn fastener

Unit Size	A	B
09 - 12	18 5/8" [473]	16 3/4" [425]
15 - 18	21 5/8" [549]	19 3/4" [502]
24 - 36	25 5/8" [650]	23 3/4" [603]

Note: All measurements are in inches, millimeters are in parenthesis. Asy = Assembly

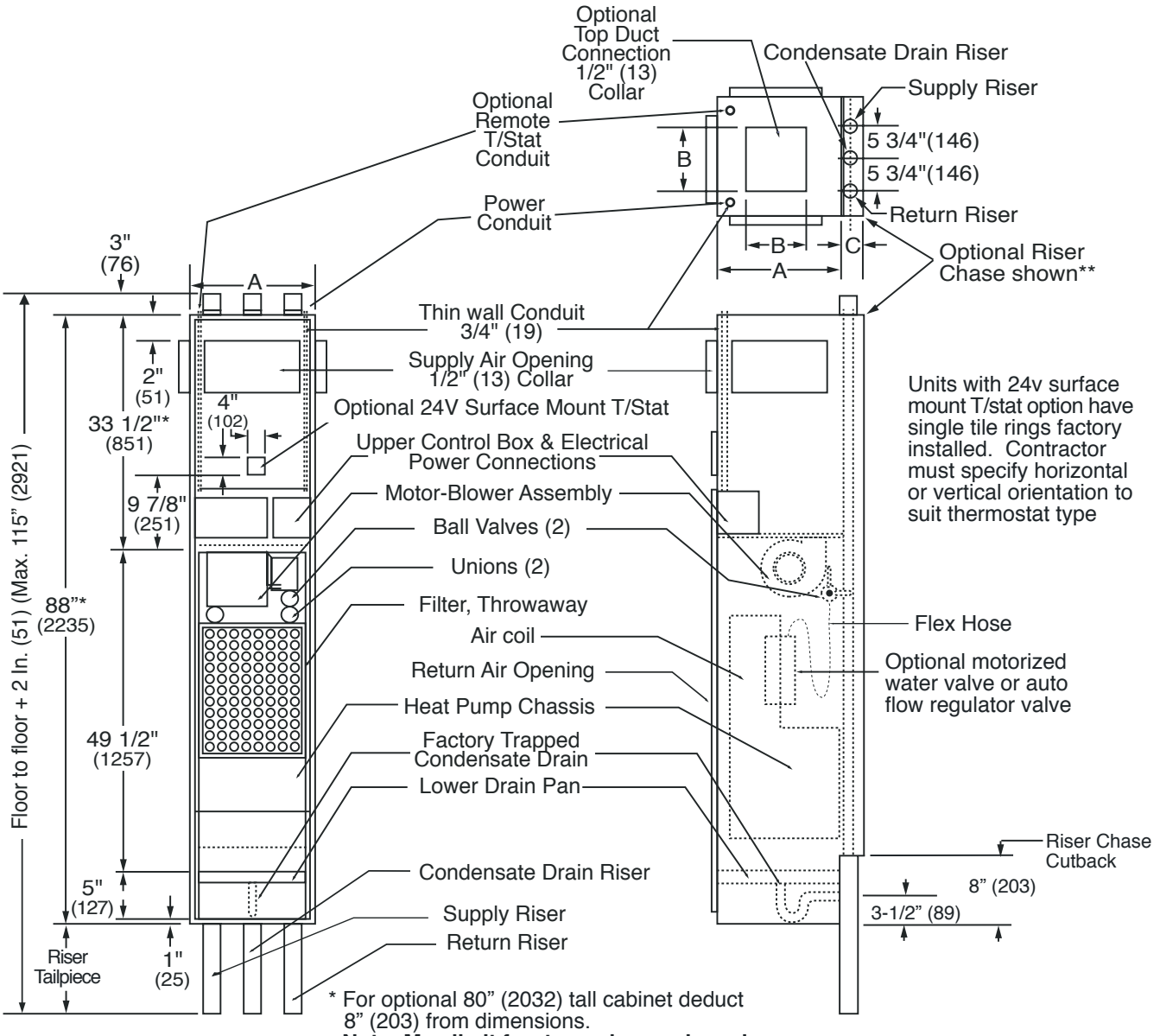
Return Air Panel - "H" Style Installation



NOTICE: Seal between the frame and cabinet with weather seal material to avoid air being pulled in from the wall cavity. DO NOT attach frame to cabinet.

Note: All measurements are in inches, millimeters are in parenthesis.

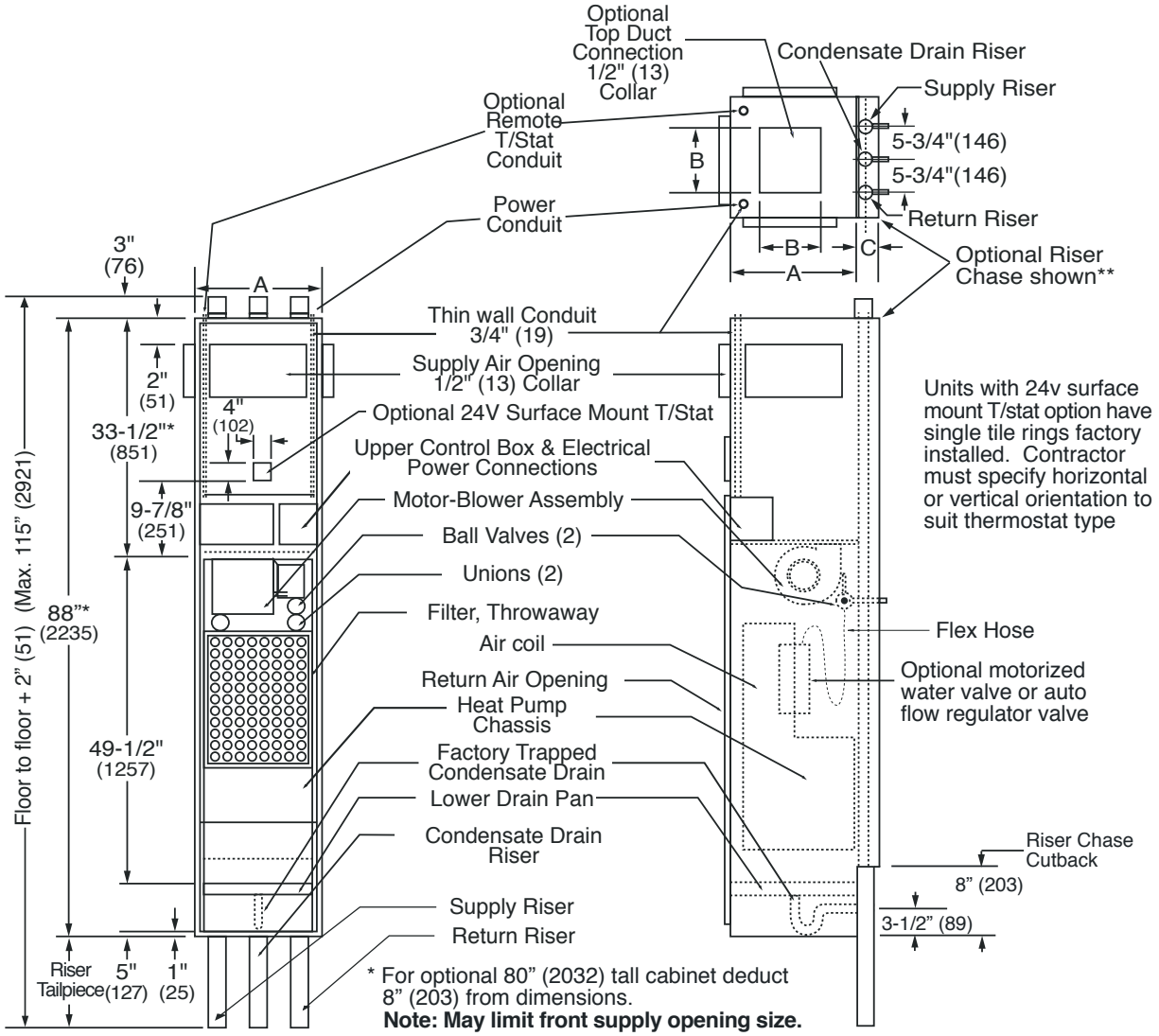
Single Unit Furred In Cabinet Dimensions


Optional Top Duct Connection 1/2" (13) Collar
Condensate Drain Riser
Supply Riser
Optional Remote T/Stat Conduit
5 3/4"(146)
5 3/4"(146)
Power Conduit
Return Riser
Optional Riser Chase shown**
3" (76)
Thin wall Conduit 3/4" (19)
Supply Air Opening 1/2" (13) Collar
2" (51)
4" (102)
33 1/2"* (851)
Optional 24V Surface Mount T/Stat
Upper Control Box & Electrical Power Connections
9 7/8" (251)
Motor-Blower Assembly
Ball Valves (2)
Unions (2)
88"* (2235)
Filter, Throwaway
Air coil
Flex Hose
Return Air Opening
Optional motorized water valve or auto flow regulator valve
Heat Pump Chassis
49 1/2" (1257)
Factory Trapped Condensate Drain
Lower Drain Pan
Floor to floor + 2 In. (51) (Max. 115" (2921)
Riser Chase Cutback
8" (203)
3-1/2" (89)
Condensate Drain Riser
5" (127)
Supply Riser
Return Riser
Riser Tailpiece
1" (25)
Units with 24v surface mount T/stat option have single tile rings factory installed. Contractor must specify horizontal or vertical orientation to suit thermostat type
* For optional 80" (2032) tall cabinet deduct 8" (203) from dimensions.
Note: May limit front supply opening size.

Unit Size	A	B	C**
TRM09 - 12	17 [432]	10 [254]	4-1/4 [92]
TRM15 - 18	20 [508]	13 [330]	4-1/4 [92]
TRM24 - 36	24 [610]	17 [432]	4-1/4 [92]

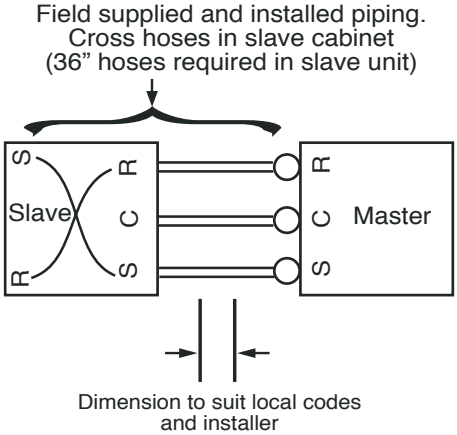
The riser compartment is defined as being the rear of each unit. Supply air grilles and return air/access panel can be any side except rear.
** C Dimension = 4-1/4" (92) for risers up to 2-1/2" (64) diameter. Consult factory for larger diameter risers.

Master Unit Furred In Cabinet Dimensions

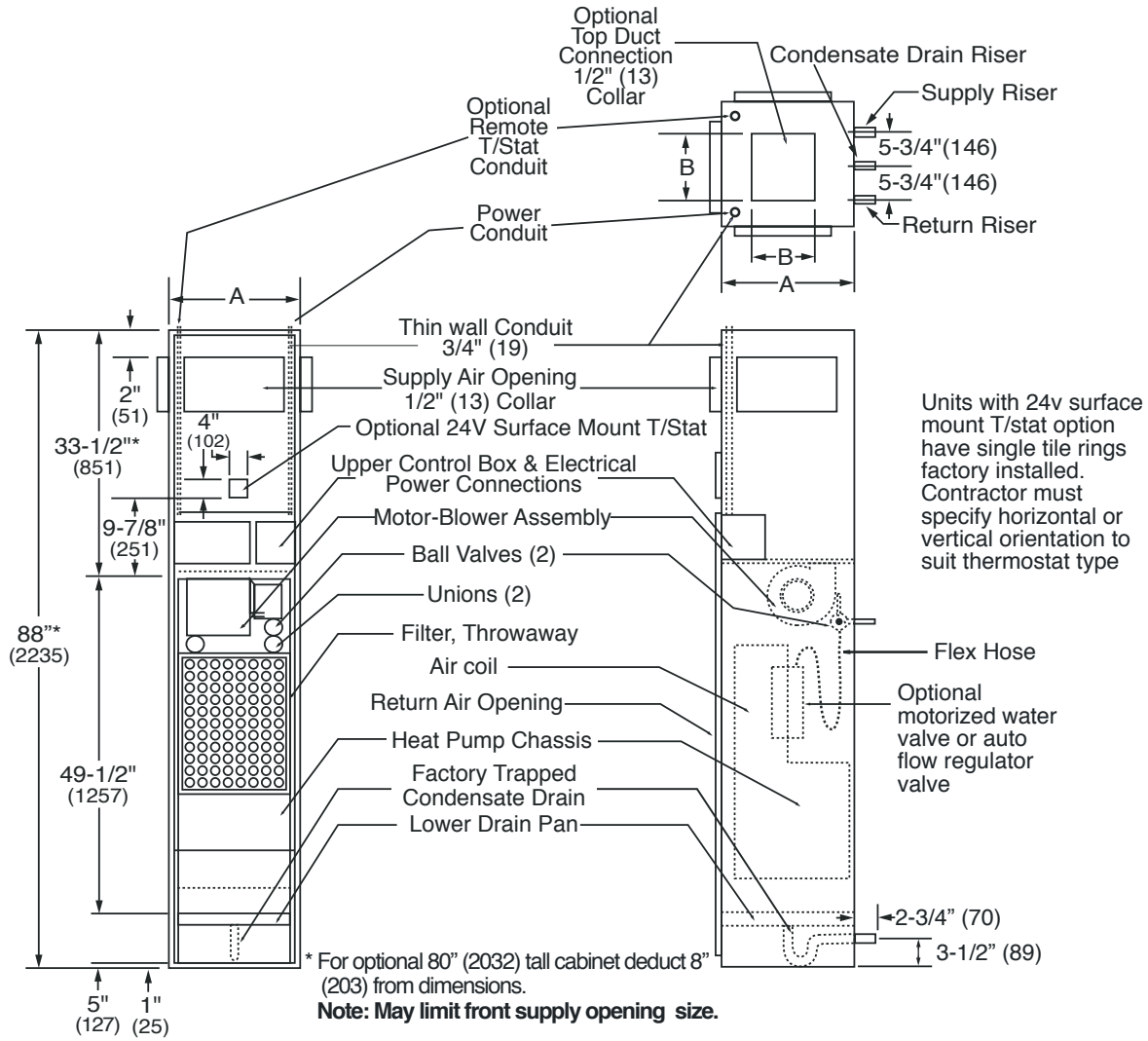


Unit Size	A	B	C**
TRM09 - 12	17 [432]	10 [254]	4-1/4 [92]
TRM15 - 18	20 [508]	13 [330]	4-1/4 [92]
TRM24 - 36	24 [610]	17 [432]	4-1/4 [92]

The riser compartment is defined as being the rear of each unit.
Supply air grilles and return air/access panel can be any side except rear.
Must provide crossover water piping from Master to Slave unit.
Master unit has no riser chase.
** C Dimension = 4 1/4" (92) for risers up to 2 1/2" (64) diameter.
Consult factory for larger diameter risers.



Slave Unit Furred In Cabinet Dimensions

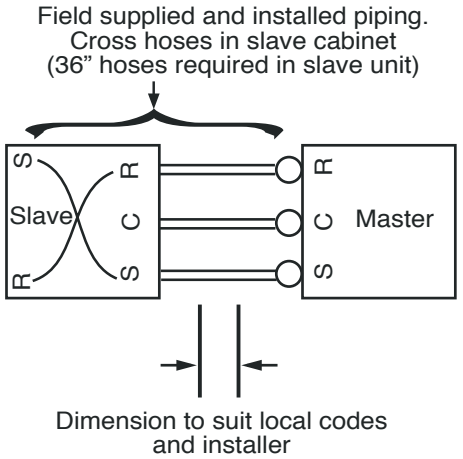


* For optional 80" (2032) tall cabinet deduct 8" (203) from dimensions.

Note: May limit front supply opening size.

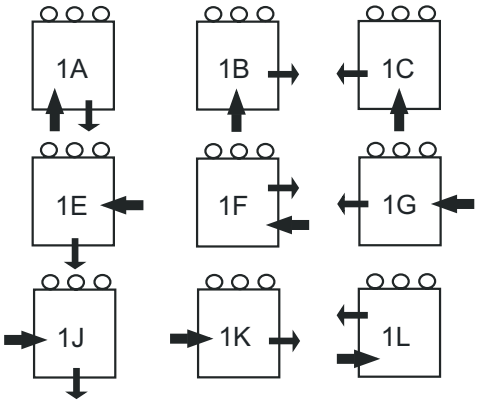
Unit Size	A	B
TRM09 - 12	17 [432]	10 [254]
TRM15 - 18	20 [508]	13 [330]
TRM24 - 36	24 [610]	17 [432]

The riser compartment is defined as being the rear of each unit. Supply air grilles and return air/access panel can be any side except rear.
Must provide crossover water piping from Master to Slave unit. Master unit has no riser chase (stub-outs only).

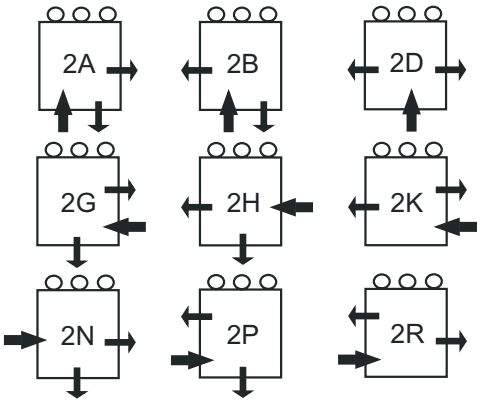


Cabinet Configurations

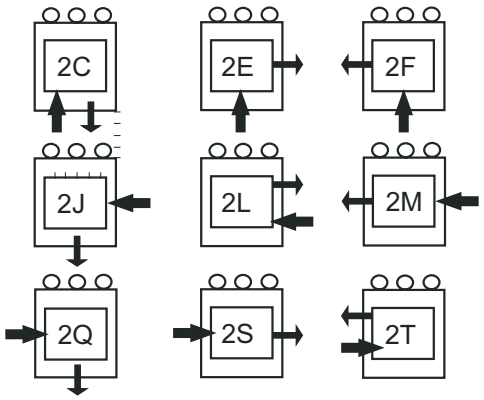
Single Supply - Side



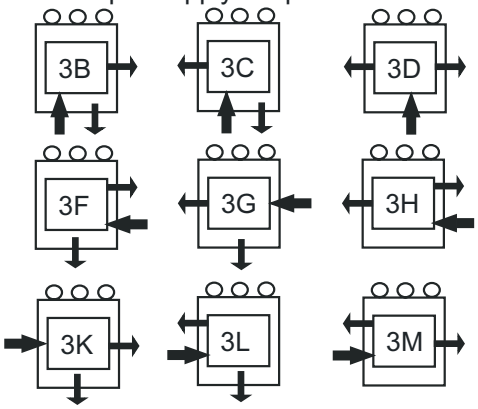
Double Supply - Side



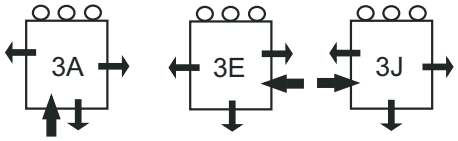
Double Supply - Top & Side



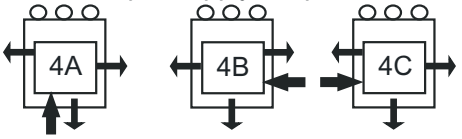
Triple Supply - Top & Sides



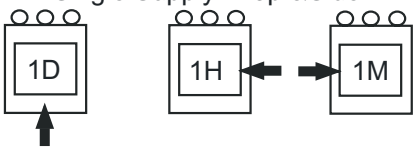
Triple Supply - Sides



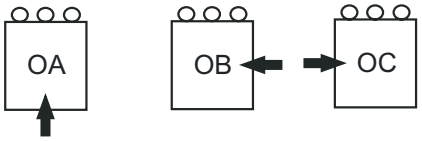
Quadruple Supply - Top & Sides



Single Supply - Top &Side



No Supply - For Field Modification



NOTES:

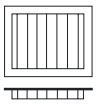
1: The riser compartment is defined as being the rear of each unit. Supply air grilles and return air/access panel can be any side except rear.
2: Return air side also defines control location and service access.
3: Triple discharge openings are not recommended for sizes TRM09 & TRM12. Single discharge openings are not recommended for sizes TRM24, 30, 36.
4: Solid plenum option for field conversion of discharge air arrangement is available.

Air Flow Vs. Grille Selection

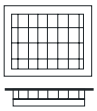
* Grilles are shipped loose for field installation after drywall has been applied to cabinets that are furred in.

** Grilles are brushed aluminum or painted (polar ice).

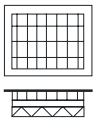
Single Deflection- Adjustable vertical blades for controlling horizontal path of discharge air.



Double Deflection- Adjustable vertical and horizontal blades for controlling horizontal and vertical path of discharge air. (Recommended for all standard applications.)

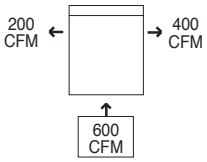


Double Deflection with Opposed Blade Damper- Addition of opposed blade damper to grille allows control of air volume (CFM) and path of discharge air. (Recommended for applications requiring unequal air flow or side discharge grille(s) with additional top discharge air opening.)



Unequal Air Flow- Air discharges requiring different air volumes (CFM). Use double deflection grilles with opposed blade damper.

Note: Units with adjacent grilles and opposed blade dampers may require special grilles. Consult factory with specific application.



Top Discharge- Units are designed to operate against relatively low air resistance (external static). Use of liberal duct sizing is recommended to maximize total unit air flow (CFM). Top duct outlet will offer more resistance to air flow than side outlets on the same cabinet. Therefore side outlet grille(s) must have opposed blade dampers to field balance the air flow.

Multiple Discharge/Top Grille & Opening Sizing When Air Flow Is Divided Equally

Unit Size	Single Discharge	Double Discharge	Triple Discharge
TRM09	12" x 10" [305 x 254]	10" x 6" [254 x 152]	Not Recommended
TRM12	12" x 12" [305 x 305]	10" x 8" [254 x 203]	Not Recommended
TRM15 - 18	16" x 12" [406 x 305]	14" x 8" [356 x 203]	14" x 6" [356 x 152]
TRM24	Not Recommended	16" x 10" [406 x 254]	16" x 6" [406 x 152]
TRM30	Not Recommended	16" x 12" [406 x 305]	12" x 10" [305 x 254]
TRM36	Not Recommended	16" x 14" [406 x 356]	16" x 10" [406 x 254]

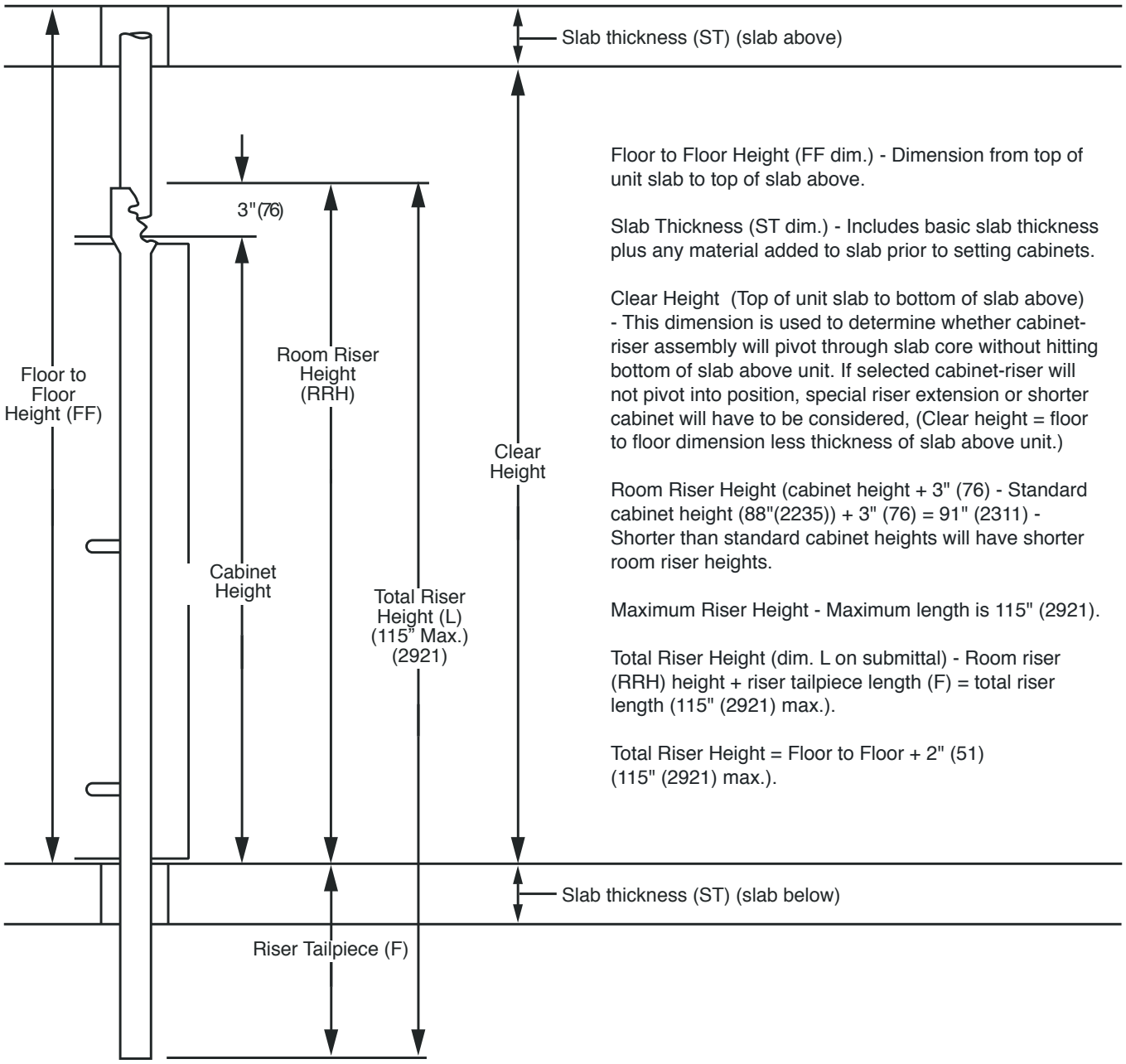
Multiple Discharge/Top Discharge Grille & Opening Sizing When Air Flow Is Divided Unequally

Model	Specified Discharge CFM	Grille Selection Chart												Top Discharge Opening Size (Up to 100% Unit CFM
		10" [254] Wide x			12" [305] Wide x			14" [356] Wide x		16" [406] Wide x				
		6"H	8"H	10"H	6"H	10"H	12"H	6"H	8"H	6"H	10"H	12"H	14"H	
09 12	100 - 150	X			X									10 x 10 [254 x 254]
	175 - 225		X											
	250 - 275			X			X							
15 18	150 - 200							X						13 x 13 [330 x 330]
	250 - 325								X					
	400 - 450										X			
24 30 36	200 - 275									X				17 x 17 [432 x 432]
	300 - 350					X								
	375 - 450										X			
	500 - 600											X		
	625 - 725												X	

Riser Definitions

Riser Tailpiece (length of riser that extends down from cabinet bottom) -
Dimension F on submittal drawing- Riser tailpiece sized for 2" (51) insertion into 3" (76) expanded section at top of cabinet. Actual job fit may be 1" (25) to 3" (76) insertion (built-in +1" (25) floor to floor tolerance). Riser tailpiece should extend beneath bottom of slab a minimum of 5" (127) to facilitate brazing.

3" Expanded Section - Riser expanded at top of unit to accept a pipe diameter from unit above. (Top of riser always 3" (76) above top of unit.)



Floor to Floor Height (FF dim.) - Dimension from top of unit slab to top of slab above.

Slab Thickness (ST dim.) - Includes basic slab thickness plus any material added to slab prior to setting cabinets.

Clear Height (Top of unit slab to bottom of slab above) - This dimension is used to determine whether cabinet-riser assembly will pivot through slab core without hitting bottom of slab above unit. If selected cabinet-riser will not pivot into position, special riser extension or shorter cabinet will have to be considered, (Clear height = floor to floor dimension less thickness of slab above unit.)

Room Riser Height (cabinet height + 3" (76) - Standard cabinet height (88"(2235)) + 3" (76) = 91" (2311) - Shorter than standard cabinet heights will have shorter room riser heights.

Maximum Riser Height - Maximum length is 115" (2921).

Total Riser Height (dim. L on submittal) - Room riser (RRH) height + riser tailpiece length (F) = total riser length (115" (2921) max.).

Total Riser Height = Floor to Floor + 2" (51) (115" (2921) max.).

Riser Arrangements - Top Floor Units

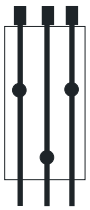
1. All Risers Capped At Cabinet Run-Outs
   • System piping is bottom supply & return

Standard for bottom supply & return unless otherwise specified.

---

2. All Risers Open At Top
   • Bottom supply & return piping for supplying water to other units
   • Bottom supply & return piping for drain vent to roof, flushing crossover
   • Top supply & return piping

Standard for top supply & return unless otherwise specified.



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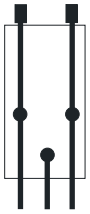
3. Supply & Return Open, Drain Capped At Cabinet Run-Out
   • Bottom supply & return piping with open top for venting or flushing crossover
   • Top supply & return



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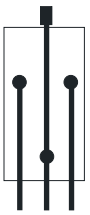
4. Capped Supply and Return, Drain Open At Top
   • Bottom supply & return piping with open drain riser for venting to roof or picking up drain from other equipment above



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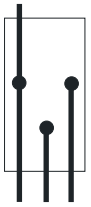
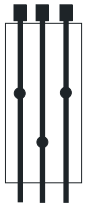
5. Supply Or Return Open At Top, Others Capped At Cabinet Run- Out
   • Bottom supply & top return piping
   • Top supply & bottom return piping



Note: Check system flushing & air venting specifications.

Riser Arrangements - Bottom Floor Units

1. All Riser Through Slab At Bottom
   - Bottom supply & return
   - Top supply & return feeding other equipment below



Standard for bottom supply & return unless otherwise specified.

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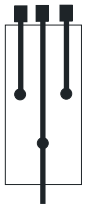
2. Supply & Return Capped At Cabinet Run-Out, Drain Through Slab
   - Top supply & return
   - Supply & return mains above these units on "Between-Floors" main piping



Standard for top supply & return unless otherwise specified.

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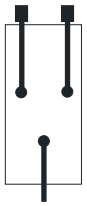
3. All Risers Capped At Cabinet Run-Out, Drain Through Slab
   - Isolated unit top supply & return from adjacent riser with separate drain
   - Check riser venting



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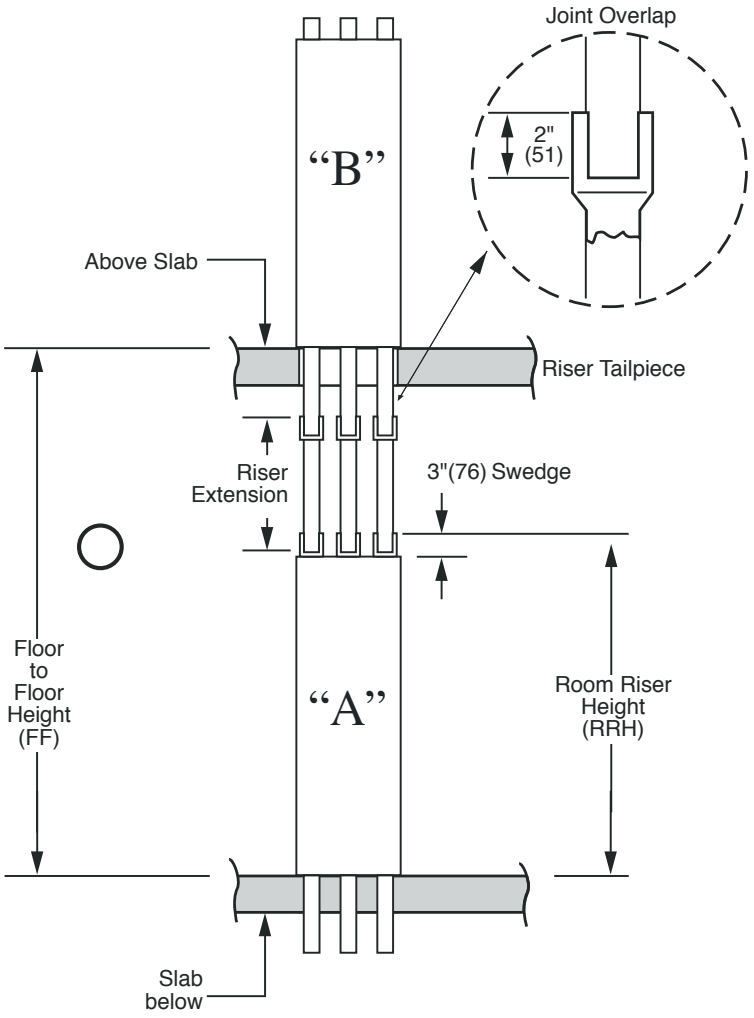
4. Supply Or Return Capped At Cabinet Run-Out, Other Risers Extend Through Slab
   - Bottom supply, top return piping
   - Bottom return, top supply piping

Note: Check system flushing and air venting specifications.

Riser Extension Sizing



Riser Tail Piece: Length of riser extending down from the cabinet. Riser tail piece must extend a minimum of 5" (127) below slab.

Room Riser Height (RRH): Cabinet height + 3" (76). Standard Cabinet is 88" (2235) + 3" (76) = 91" (2311).

Floor To Floor Height (FF): Distance from top of unit slab to top of above slab.

Riser Extension Length: Start with the floor to floor Dim. (FF) From this subtract the room riser height and tail piece length. Then add 4" (102) to the two joint overlaps.

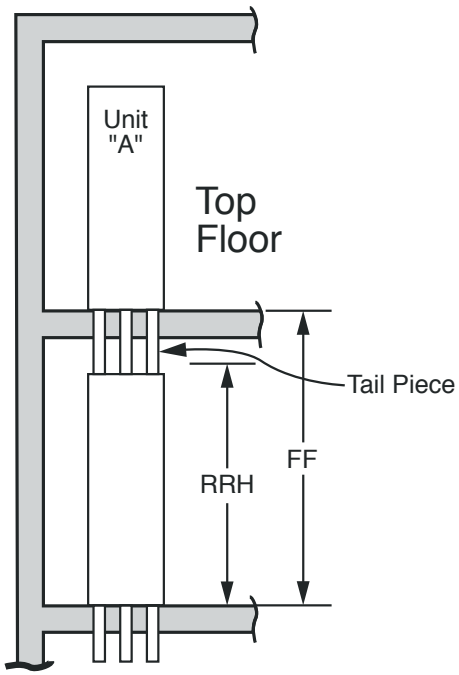
Riser Extension: FF - (tailpiece + RRH) + 4" (102).

Example: Floor to floor (FF) = 120" (3048)
Room Riser Height (RRH) = 91" (2311)
Tail Piece = 13" (330).

Riser Extension: 120" (3048) - (13" (330) + 91" (2311)) + 4" (102) = 20" (508).

NOTE: Riser extensions are ordered for unit on floor above (example shown - riser extensions would be for Unit "B")

Riser Length Sizing



To determine the riser tail piece length of a unit (unit "A").

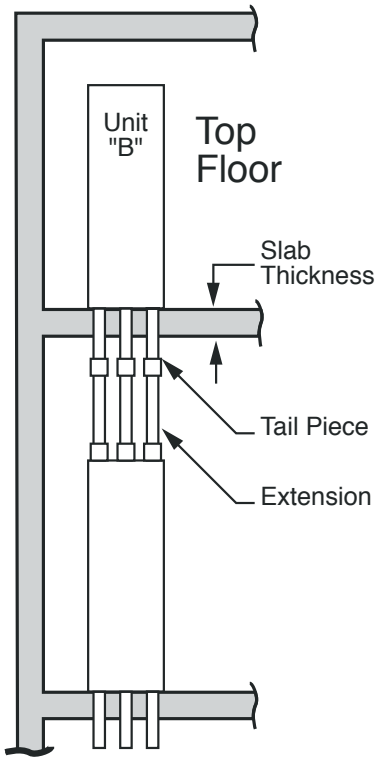
Riser Tail Piece (of unit A)= FF - RRH + 2" (51).

RRH: Room riser height is cabinet height + 3" (76).

Standard cabinet height is 88" (2235).

RRH= 88" (2235) + 3" (76) = 91" (2311).

FF: Floor to Floor height is the dimension from the top of the slab above to the top of the slab below.



To determine the riser tail piece length of a unit (unit "B") that will require riser extensions to a unit below.

Minimum Tail Piece Length (of unit "B") = slab thickness + 5" (127).

To determine riser extensions lengths see page Riser Extension Sizing.

Note: If riser length exceeds 115" (2921), riser extensions must be used. See Riser Extension Sizing. The riser tail piece must extend through the slab a minimum of 5" (127) to facilitate brazing. Special care must be taken in sizing riser lengths and tail piece lengths when:
A) Riser extensions are used.
B) Floor to floor heights vary.
C) Slab thickness varies from floor to floor.

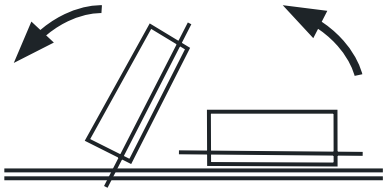
See Riser Arrangement for selection of top floor riser applications.

Cabinet Heigth and Slab Slot Size

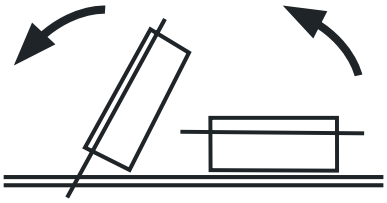
To determine the slab slot size required for the risers and to determine if clear height is OK for unit installation, use the cabinet height and slab slot charts on the next page.

To use the charts you will need the clear height in the room the unit is in, size of unit, number of risers, riser dimensions and type of installation. (See below)

Type 1 Single Units
With a minimum clear height of 94" (2388). Start with the unit lying on the chase.



Type 2 Single Units
With a minimum clear height of 96" (2438). Start with the unit lying with the chase on top.



Type 3 Single
With a minimum clear height of 94" (2388). Start with the unit lying on its side as shown.

If any clear height is less than 96" (2438) check the minimum cabinet height and slot size chart to determine if the size unit you need will fit. If the standard 88" (2235) cabinet does not fit check the short 80" (2032) cabinet height and slot size chart. Call the factory if the short 80" (2032) cabinet does not fit. Check with the contractor for OK to use 80" (2032) cabinet.

Clear Height (swing height) = Floor to Floor Dimensions - Slab Thickness of Slab above the unit. CH = FF - ST.

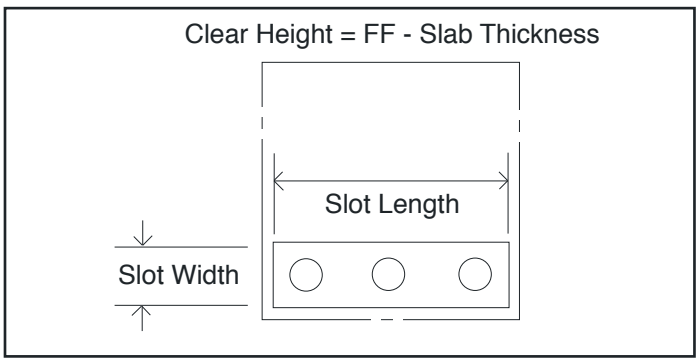
Slab Slot Chart - 3 Pipe

Model TRM	Clear Height	Slab Slot Size		
		Type of Installation		
		Type 1	Type 2	Type 3
		W x L	W x L	W x L
09 - 12	96 95 94 93 92	5 7/8" X 15" [149 X 381] 6 1/4" X 15" [159 X 381] 6 5/8" X 15" [168 X 381] 7" X 15" [179 X 381] 7 1/2" X 15" [191 X 381]	5 7/8" X 15" [149 X 381] 5 3/8" X 15" [137 X 381] 5 3/8" X 15" [137 X 381] Not Recommended Not Recommended	5" X 15" [127 X 381] 5" X 15" [127 X 381] 5" X 15" [127 X 381] 5" X 15" [127 X 381] Not Recommended
15 - 18	96 95 94 93	6 1/4" X 18" [159 X 457] 6 3/4" X 18" [171 X 457] 7 1/8" X 18" [181 X 457] 7 5/8" X 18" [194 X 457]	5 1/8" X 18" [130 X 457] 5 3/8" X 18" [137 X 457] Not Recommended Not Recommended	5" X 18" [127 X 457] 5" X 18" [127 X 457] 5" X 18" [127 X 457] 5" X 18" [127 X 457]
24 - 36	96 95 94	7" X 22" [178 X 559] 7 1/2" X 22" [191 X 559] 8" X 22" [203 X 559]	5 1/8" X 22" [130 X 599] Not Recommended Not Recommended	5" X 22" [149 X 599] 5" X 22" [149 X 599] 5" X 22" [149 X 599]
09 - 12	91 or less	Not Recommended	Not Recommended	Not Recommended
15 - 18	92 or less	Not Recommended	Not Recommended	5" X 18" [149 x 457]
24 - 36	93 or less	Not Recommended	Not Recommended	5" X 22" [127 x 599]

To use this chart look down the model column to find the model. Then look across to find the clear height. If your clear height exceeds 96" use the 96" slab slot size. Then under the type of installation read the slab slot size.

Above charts allow 1" tolerance in clear height to allow for variance in floor to floor dimensions.

Clear height is the floor to floor dimension of the floor the unit is on minus the slab thickness above.



Shipping

Units Are Shipped FOB Factory

ClimateMaster Hi-Rise Cabinets are normally shipped to the jobsite on dedicated open flatbeds trailers, palletized for maximum shipping density, grouped together by building, size and floor where possible, wrapped and covered with tarp for protection (Figure 1). The size of each pallet depends upon the cabinet size and number of cabinets (Figure 2).

Special shipping accommodations can be provided by ClimateMaster. Examples might include:

- Closed truck or container shipping, on special end fork pallets.
- Reduced height, width or weight pallets.
- Unit grouped on pallets by riser instead of floor (for example, a retrofit job).
- Export or over-crating.
- Risers shipped separately from cabinets.

However, any such special shipping needs must be included with the order of the units. ClimateMaster will charge extra for any accommodations which significantly increase the cost of the shipment.

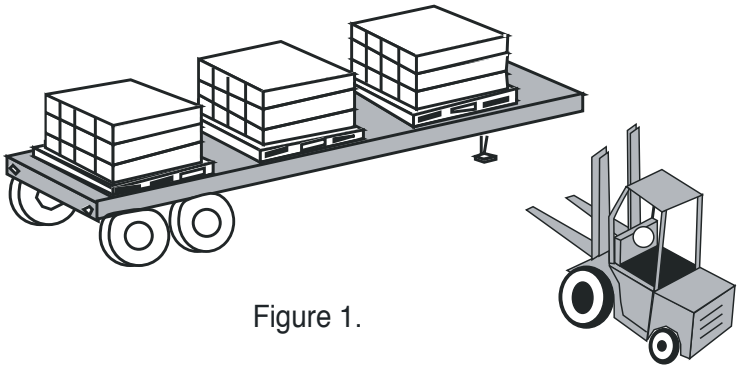


Figure 1.

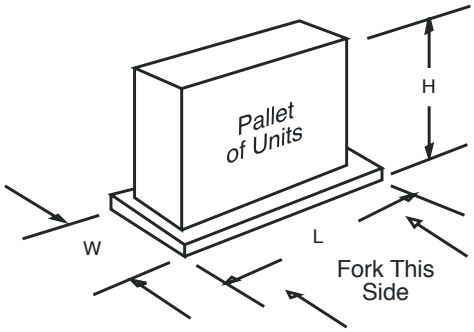


Figure 2.

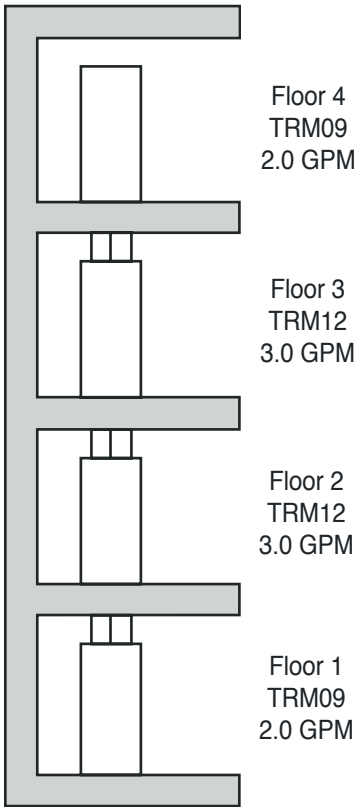
Cabinet Size	# of Cabinets	L (in.)	W (in.)	H (in.)	Approx. Weight per pallet	Approx. Quantity per truck
09 - 12	4	106*	22	84	725	80
	8	106*	44	84	1450	80
15 - 18	4	106*	25	96	785	80
	8	106*	50	96	1570	80
24 - 36	3	106*	29	87	750	60
	6	106*	58	87	1500	60

* 106" for standard, 104" long risers (typically add 2" to riser length.)

Riser GPM Sizing

Riser GPM requirements and individual Unit GPM requirements are necessary to select the proper Riser Piping diameters. Refer to this page to determine GPM requirement, then refer to Riser Diameter Sizing Table to determine Riser Piping diameters.

Example is for bottom supply - bottom return system feed loop. GPM's are dependent upon unit load and system loop water temperatures. Please refer to Performance Charts for individual Unit GPM requirements.



Unit GPM (UGPM) = Required gallon per minute from "Performance Charts," in "Vertical Stacked Design Guide."

Total Riser GPM (TRGPM) = The sum of, all Units, GPM on each Riser.

Total GPM Per Floor (TGF) = Total GPM minus the sum of Unit GPM from all floors below. TGF = TRGPM - (sum UGPM from units below).

Example: Four floors, Consisting of units sizes TRM09 and TRM12, as shown in diagram. GPM's are 2.0 and 3.0 respectively.

TRGPM = 2.0 + 3.0 + 3.0 + 2.0 = 10 GPM.

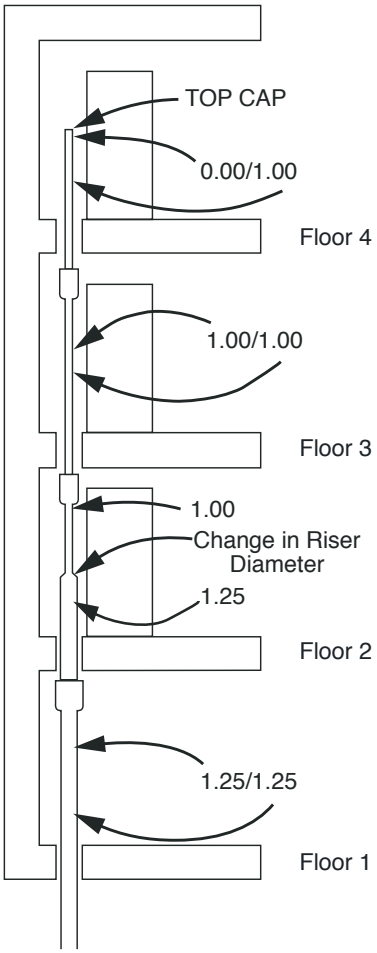
Floor 4: TGF = 10 - (3.0 + 3.0 + 2.0) = 2 GPM needed at floor 4.
Floor 3: TGF = 10 - (3.0 + 2.0) = 5 GPM needed at floor 3.
Floor 2: TGF = 10 - (2.0) = 8 GPM needed at floor 2.
Floor 1: TGF = 10 - (no floors below) = 10 GPM needed at floor 1.

Refer to Riser Diameter Sizing page.

Riser Diameter Sizing

Refer to Riser GPM Sizing for the prefix to this example.

Each TRM Vertical Stack unit has three riser pipes. The following example will be for one riser pipe (from the top floor to the bottom floor), and will be representative of the remaining two riser pipes.



From Table 1 (below) determine the proper riser diameter needed to satisfy the required GPM's at each unit. Refer to Table 2 (below) for a summary.

The following nomenclature is used to designate the diameters at the top and bottom of each unit.

Top Cap - Top half of riser is eliminated and sealed.
Bottom Cap - Bottom half of riser is eliminated and sealed.
0.00/1.00 - Indicates top cap/1" bottom.
1.00/1.25 - Indicates 1" top/1.25" bottom.
1.25/0.00 - Indicates 1.25" top/bottom cap.
(from this we develop Table 3)

Note: Transitions limited to 1 nominal diameter size larger or smaller within each floor.

Table 1

Maximum GPM	12	20	34	70	125	300
Nominal Riser Diameter	1”	1-1/4”	1-1/2”	2’	2-1/2”	3”

Table 2

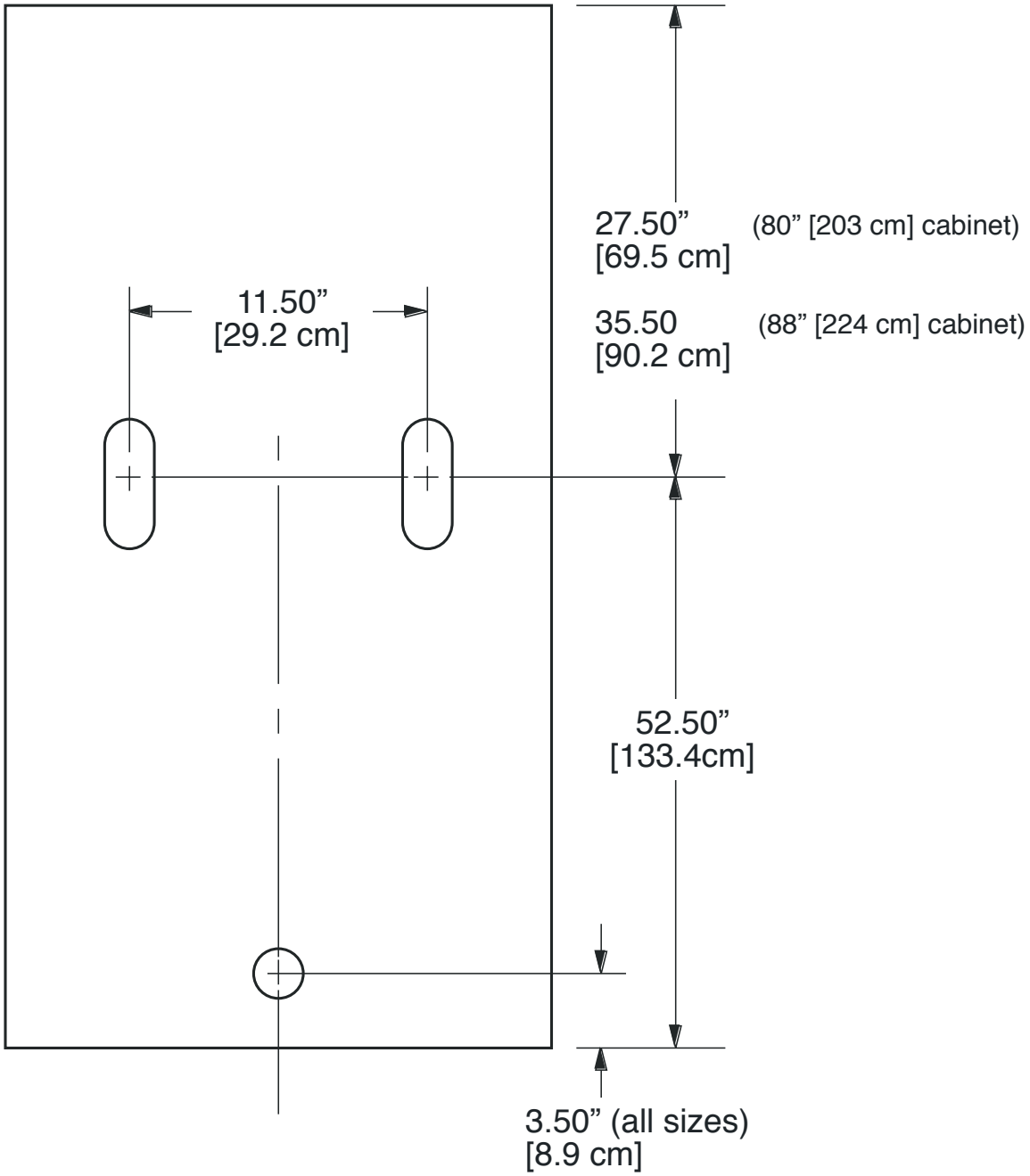
Floor	GPM	Diameter From Table 1
4	2	1” [19]
3	5	1 [19]
2	8	1” [25.4]
1	10	1.25” [25.4]

Table 3

Nomenclature per Unit	Description
0.00/1.00	Top Cap, w/1” Bot Feed
1.00/1.00	1” Full Length Riser
1.00/1.25	1” Top, 1.25” to 1st Floor
1.25/1.25	1.25” Full Length Riser

Values from Table 3 are to be entered on the Riser Piping Schedule. Top diameter must match bottom diameter of floor above.

Riser Slot Arrangements



Always figure riser extension from the bottom of the cabinet, total extension length is effective length plus 2" [5.1 cm]

Standard riser arrangement is 3" [7.6 cm] above and 13" [33 cm] below to 24” [61 cm] below (overall riser=115” [292.1 cm] Max.)

Type M and L copper available

Blower Performance Data

Airflow in CFM with wet coil and clean air flilter.

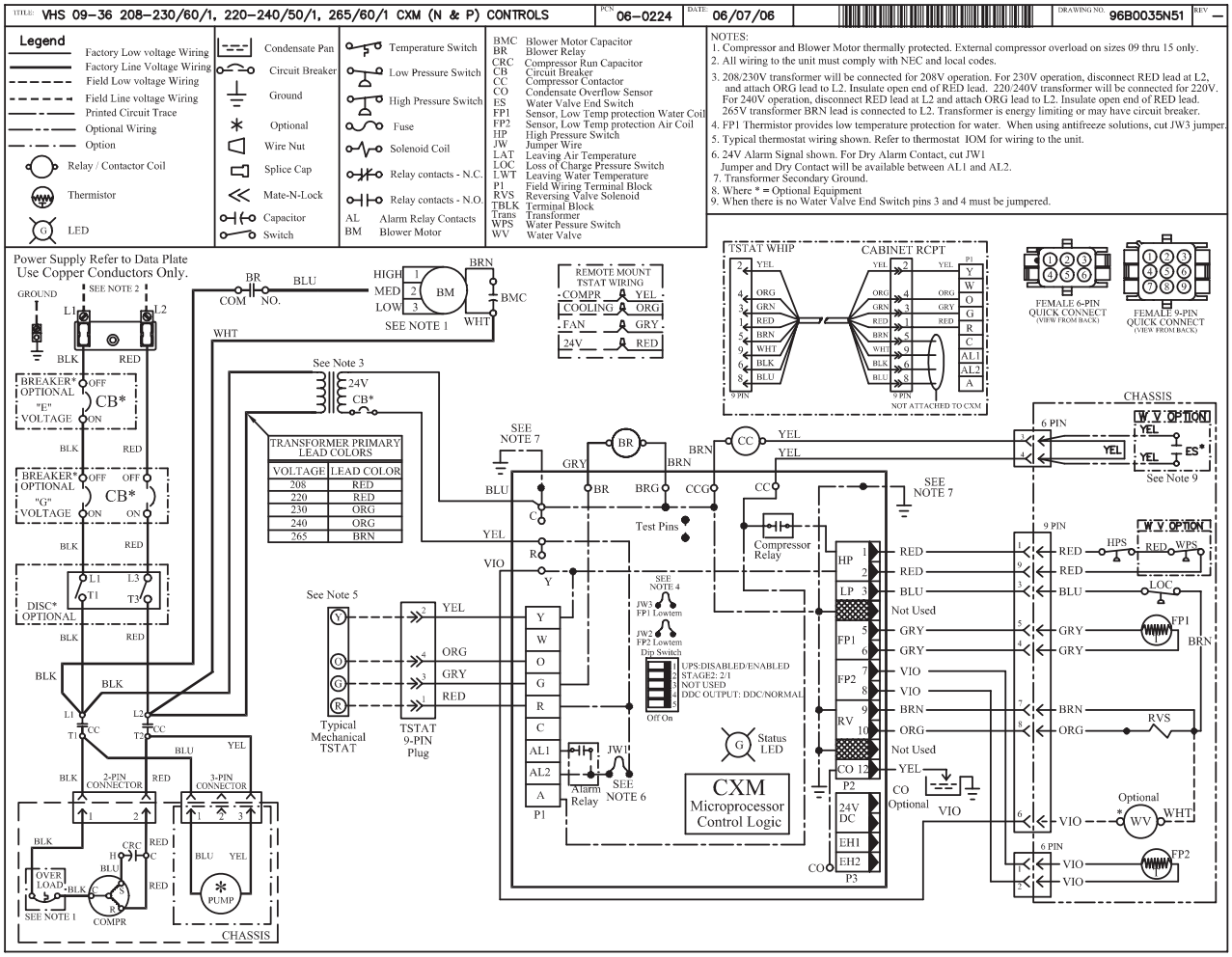
Model	Fan Speed	Rated Airflow	Min CFM	Airflow (cfm) at External Static Pressure (in. wg)															
				0.00	0.01	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70
TRM09	HI	405	284	408	403	376	346	319	292										
	LOW			349	343	320	296												
TRM12	HI	445	312	445	434	409	378	349	320										
	LOW			345	341	325													
TRM15	HI	595	416	689	686	672	664	652	642	633	618	605	590	568	539	511	477		
	MED			595	593	576	564	554	544	534	525	509	493	447	427				
	LOW			519	516	505	487	475	449	437	423								
TRM18	HI	685	480	685	682	674	664	653	640	627	612	594	575	553	528	500			
	MED			591	589	581	572	562	552	541	529	515	498	480					
	LOW			514	511	503	492	482											
TRM24	HI	850	596	850	845	830	808	783	785	730	703	672	641	611					
	MED			761	749	727	707	679	655	628	602								
	LOW			653	648	630	610	596											
TRM30	HI	1140	798	1346	1340	1310	1284	1221	1172	1135	1108	1069	1036	996	959	910	864		
	MED			1140	1130	1113	1101	1077	1056	1030	1010	979	952	917	886	840	798		
	LOW			1008	996	980	968	949	934	914	897	870	846	810					
TRM36	HI	1260	882	1262	1259	1234	1209	1180	1153	1122	1091	1057	1024	989	954	913			
	MED			1129	1125	1107	1090	1068	1046	1020	996	965	935	901					
	LOW			1010	1007	995	980	962	940	938	916	893							

Units factory shipped on high speed. Other speed required field selection.
All airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 208V for 208-230V units.
All units ARI/ISO/ASHRAE 13256-1 rated on high fan speed.

Unit Electrical Data

Model	Voltage Code	Voltage	Min/Max Voltage	Compressor		Fan Motor FLA	Standard Units			Units with Secondary Loop Pump		
				RLA	LRA		Total Unit FLA	Min Circuit Amps	Max Fuse/ HACR	Total Unit FLA	Min Circuit Amps	Max Fuse/ HACR
TRM09	G	208-230/60/1	197/254	4.5	23.0	0.31	4.8	5.9	15	5.2	6.3	15
TRM12	G	208-230/60/1	197/254	5.3	30.0	0.70	6.0	7.4	15	6.4	7.8	15
TRM15	G	208-230/60/1	197/254	5.8	30.0	1.00	6.8	8.3	15	7.6	9.1	15
TRM18	G	208-230/60/1	197/254	6.8	38.0	1.0	7.8	9.5	15	8.6	10.3	15
TRM24	G	208-230/60/1	197/254	14.3	58.3	1.10	15.4	19.0	30	16.2	19.8	30
TRM30	G	208-230/60/1	197/254	14.3	64.0	1.80	16.1	19.7	30	16.9	20.5	30
TRM36	G	208-230/60/1	197/254	15.7	77.0	1.80	17.5	21.4	35	18.3	22.2	35

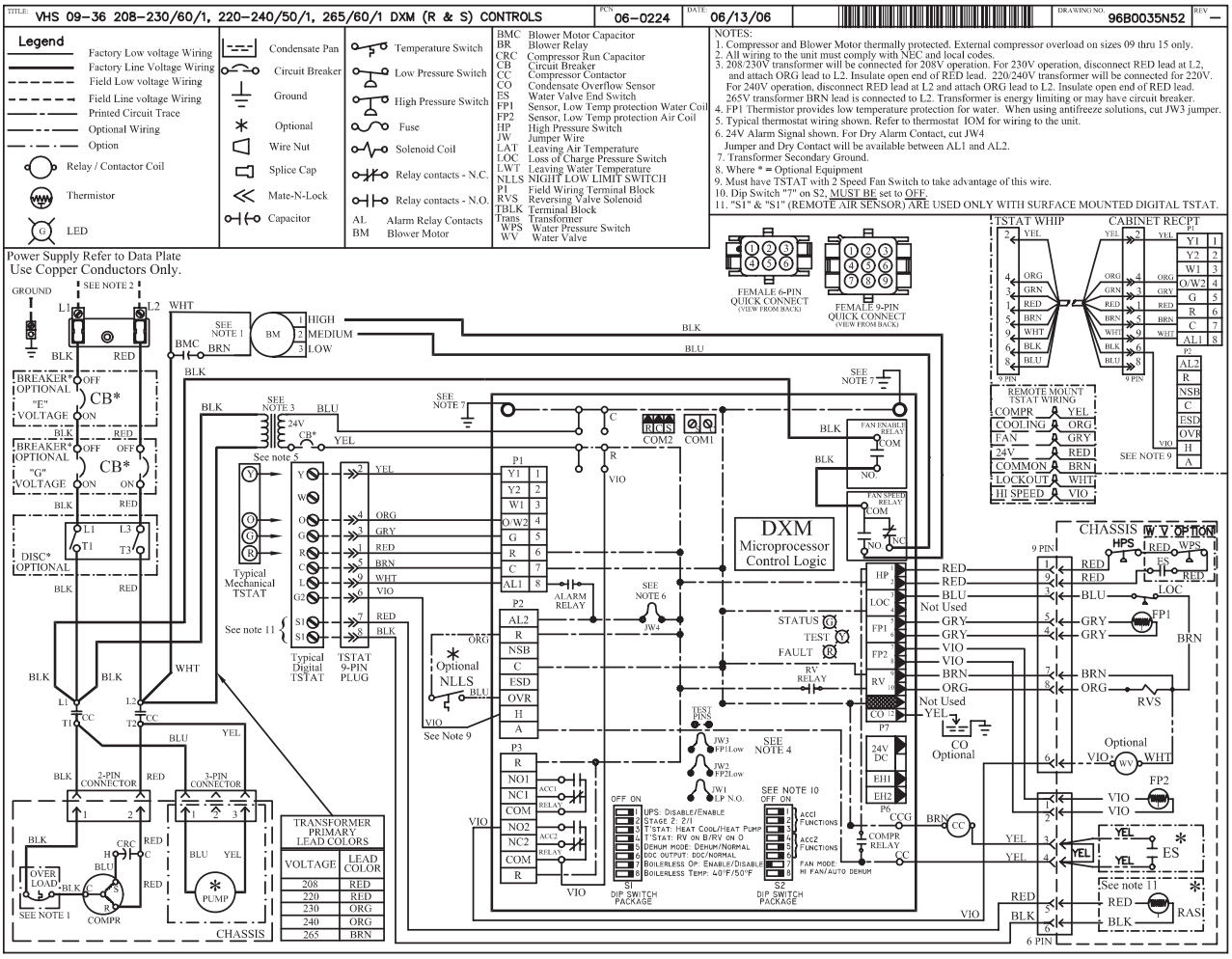
Typical Wiring Diagram - CXM Controls - Single Phase



CXM CONTROLLER FAULT CODES

DESCRIPTION OF OPERATION	LED	ALARM RELAY
NORMAL MODE	ON	OPEN
NORMAL MODE W/ UPS WARNING	ON	CYCLE (CLOSED 5 SEC. OPEN 25 SEC.)
CXM IS NON-FUNCTIONAL	OFF	OPEN
FAULT RETRY	SLOW FLASH	OPEN
LOCKOUT	FAST FLASH	CLOSED
OVER/UNDER VOLTAGE SHUTDOWN	SLOW FLASH	OPEN (CLOSED AFTER 15 MIN.)
TEST MODE-NO FAULT IN MEMORY	FLASHING CODE 1	CYCLING CODE 1
TEST MODE-HP FAULT IN MEMORY	FLASHING CODE 2	CYCLING CODE 2
TEST MODE-LP FAULT IN MEMORY	FLASHING CODE 3	CYCLING CODE 3
TEST MODE-FP1 FAULT IN MEMORY	FLASHING CODE 4	CYCLING CODE 4
TEST MODE FP2-FAULT IN MEMORY	FLASHING CODE 5	CYCLING CODE 5
TEST MODE-CO FAULT IN MEMORY	FLASHING CODE 6	CYCLING CODE 6
TEST MODE-OVER/UNDER SHUTDOWN IN MEMORY	FLASHING CODE 7	CYCLING CODE 7
TEST MODE-UPS IN MEMORY	FLASHING CODE 8	CYCLING CODE 8
TEST MODE-SWAPPED FP1 TO FP2	FLASHING CODE 9	CYCLING CODE 9

Typical Wiring Diagram - DXM Controls - Single Phase



DXM CONTROLLER FAULT CODES

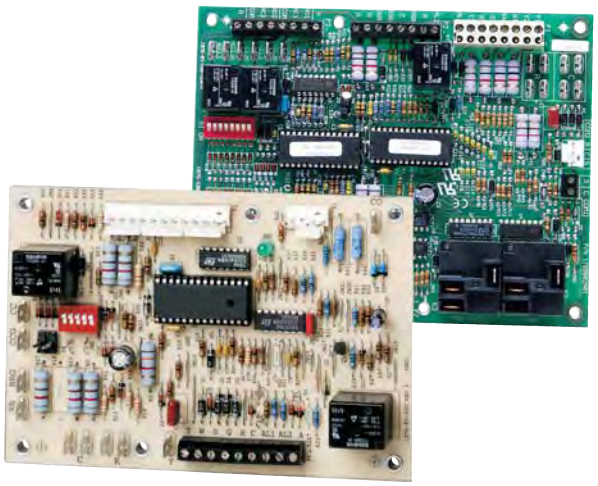
DXM CONTROLLER FAULT CODES				
OPERATION	STATUS LED (GREEN)	TEST LED (YELLOW)	FAULT LED (RED)	ALARM RELAY
NORMAL MODE	ON	OFF	NOTE: 2	OPEN
DXM IS NON-FUNCTIONAL	OFF	OFF	OFF	OPEN
TEST MODE	–	ON	NOTE: 2	Cycle (Note 3)
NIGHT SETBACK	FLASHING CODE 2	–	NOTE: 2	–
EMERGENCY SHUT DOWN	FLASHING CODE 3	–	NOTE: 2	–
INVALID T-STAT INPUTS	FLASHING CODE 4	–	NOTE: 2	–
NO FAULT IN MEMORY	ON	OFF	FLASHING CODE 1	OPEN
HP: FAULT / (LOCKOUT) NOTE: 1	SLOW FLASH/ (FAST FLASH)	OFF	FLASHING CODE 2	OPEN / (CLOSED)
LP: FAULT / (LOCKOUT) NOTE: 2	SLOW FLASH/ (FAST FLASH)	OFF	FLASHING CODE 3	OPEN / (CLOSED)
FPI: FAULT / (LOCKOUT) NOTE: 1	SLOW FLASH/ (FAST FLASH)	OFF	FLASHING CODE 4	OPEN / (CLOSED)
FP2: FAULT / (LOCKOUT) NOTE: 1	SLOW FLASH/ (FAST FLASH)	OFF	FLASHING CODE 5	OPEN / (CLOSED)
CO: FAULT / (LOCKOUT) NOTE: 1	SLOW FLASH/ (FAST FLASH)	OFF	FLASHING CODE 6	OPEN / (CLOSED)
OVER-UNDER VOLTAGE	SLOW FLASH	OFF	FLASHING CODE 7	OPEN(NOTE4)
NORMAL MODE w/UPS	ON	OFF	FLASHING CODE 8	CYCLE (NOTE5)
SWAPPED FP1/FP2 LOCKOUT	FAST FLASH	OFF	FLASHING CODE 9	CLOSED

1. STATUS LED (GREEN) : SLOW FLASH – CONTROLLER IN FAULT RETRY MODE, FAST FLASH – CONTROLLER IN LOCKOUT MODE SLOW FLASH = 1 FLASH PER EVERY 2 SECONDS. FAST FLASH = 2 FLASHES PER EVERY 1 SECOND.
2. FAULT LED (RED) FLASHES A CODE REPRESENTING LAST FAULT IN MEMORY. IF NO FAULT IN MEMORY, CODE 1 IS FLASHED.
3. CYCLES APPROPRIATE CODE, BY CYCLING ALARM RELAY IN THE SAME SEQUENCE AS FAULT LED.
4. ALARM RELAY CLOSES AFTER 15 MINUTES.
5. ALARM RELAY CYCLES : CLOSED FOR 5 SECONDS AND OPEN FOR 25 SECONDS. . . .

CXM AND DXM SERIES CONTROLLERS

The CXM and DXM Series Controllers are designed to enhance Water-Source Heat Pump unit performance with the ability to coordinate complete systems. CXM Series controllers offer complete stand-alone unit control. DXM Series controls add advanced unit operation and system control features. Either control can allow you to connect your heat pump system to a LonWorks or MPC (Multiple ProtoCol -- BACNET, N2, Modbus) DDC control system which includes lighting and other energy saving controls. The CXM and DXM Series are the most advanced controllers made by any heat pump manufacturer today.

DXM Control Board



CXM Control Board

STANDARD CXM CONTROL FUNCTIONS

The CXM controller package offers all of the basic features available with electromechanical systems, plus 15 additional standard functions. This group of added features includes condensate overflow, anti-short cycle, random start, aircoil low temperature limit (except GC Series and water-to-water units), under/over voltage protection, and intelligent reset, designed to automatically restart a unit within a specific period of time following a fault, given the fault has been adequately corrected. Also included are LED fault and status indication to aid in diagnostics and troubleshooting. These added features, and the many others provided, are specifically designed to improve the life expectancy, reliability, and serviceability of Water-Source Heat Pumps. The CXM is compatible with most heat pump thermostats.

ADDITIONAL DXM CONTROL FUNCTIONS

The DXM controller adds system functions such as emergency shutdown and night setback with override to the stand-alone capability provided by the CXM. Fully configured, the DXM offers 17 additional features over the CXM, including advanced system control capabilities such as intelligent fan speed, reheat control, two-stage compressor, and boilerless electronic heat. The DXM is compatible with almost any type of thermostat, whether heat pump or heat/cool.

UNIT/SYSTEM OPERATING EFFICIENCY

Emergency shutdown, night setback, pump restart and advanced unit functional control all work to enhance the performance of your system. These features are standard on DXM Series Electronic Controllers.

COMFORT CONTROL

User selectable or intelligent control of fan speed, dehumidification modes, outdoor air damper control, and a complete offering of accurate electronic thermostats add up to increased comfort through superior unit control.

DIAGNOSTICS

ClimateMaster controls provide on-board diagnostics which highlight eight (seven for GC Series) different reasons for unit malfunction, speeding up service time, eliminating unnecessary service charges, and minimizing down time. The exclusive UPS (Unit Performance Sentinel) provides an early warning of inefficient operating conditions before unit shutdown actually occurs. Fault types are not only indicated at the control, but are kept in memory after a user reset for future service use. And another ClimateMaster exclusive, fault types can be displayed on a conventional thermostat if equipped with a fault LED, or can be remotely communicated with the DDC option.

OPEN-PROTOCOL DDC CAPABILITY

The CXM and DXM Series can be upgraded with the addition of a separate LonMark or MPC (Multiple ProtoCol -- BACNET, N2, Modbus) DDC module, either as a factory option, or field installed at a later date.

LonWorks is an open protocol DDC network, which can be integrated with most third-party building automation systems. In addition, the MPC controller offers the other popular building management system protocols (BACNET, N2, Modbus). ClimateMaster's DDC options provide the flexibility to upgrade your control system as your demands require, and gives you the freedom to interface with most any DDC system vendor. Leaving air and water temperature sensors are factory mounted, for remote monitoring, and a wide range of wall sensors are available. The wall sensors utilize a simple interface and can provide digital display and the unit control capability found in conventional thermostats.

ASW Wall Sensors for Lon or MPC DDC Systems

Basic Features	CXM	CXM-Lon	CXM-MPC	DXM	DXM-Lon	DXM-MPC
High and Low Refrigerant Pressure Protection	S	S	S	S	S	S
Water Coil Low Temperature Limit	S	S	S	S	S	S
True 24VA Thermostat Signals	S	S	S	S	S	S
Thermostat Inputs Compatible with Triacs	S	S	S	S	S	S
Condensate Overflow Sensor	S	S	S	S	S	S
Anti-Short-Cyle Time Delay	S	S	S	S	S	S
Random Start	S	S	S	S	S	S
Alarm (selectable dry contact or 24VA)	S	S	S	S	S	S
Water Valve Relay	S	S	S	S	S	S
Water Valve Relay with Compressor Delay	N/A	N/A	N/A	S	S	S
Emergency Shutdown	N/A	DDC	DDC	S	DDC	DDC
Night Setback with Override	N/A	DDC	DDC	S	DDC	DDC
Outdoor Air Damper Control	N/A	N/A	N/A	S	S	S
Advanced Features						
Intelligent Reset	S	S	S	S	S	S
High and Low Voltage Protection	S	S	S	S	S	S
Air Coil Low Temperature Limit	S	S	S	S	S	S
Freeze Setpoint Field Select (water, antifreeze)	S	S	S	S	S	S
Electric Heat Control Outputs	S	S	S	S	S	S
Boilerless Electric Heat Control	N/A	N/A	N/A	S	S	S
Intelligent Reversing Valve Operation	N/A	DDC	DDC	S	S	S
High/Low Fan Speed Outputs	N/A	N/A	N/A	S	S	S
Intelligent Fan Speed Control	N/A	N/A	N/A	S	S	S
Thermostat Type Select (Y,O or Y,W)	N/A	N/A	N/A	S	N/A	N/A
Reversing Valve Signal Select (O or B)	N/A	N/A	N/A	S	N/A	N/A
Dehumidistat Input	N/A	N/A	N/A	S	S	S
Reheat Dehumidification Control*	N/A	N/A	N/A	O	O	O
Multiple Units on One Thermostat/Wall Sensor	N/A	DDC	DDC	S	DDC	DDC
Service and Reliability Features						
Service Test Mode	S	S	S	S	S	S
LED Fault and Status Lights	S	S	S	S	S	S
Fault Memory after Reset	S	S	S	S	S	S
Unit Performance Sentinel	S	S	S	S	S	S
Harness-Type Factory Wiring Connections	S	S	S	S	S	S
Fully Noise-Tested Design	S	S	S	S	S	S
CE Approval	S	S	S	S	S	S
Removable Low Voltage Connector	N/A	N/A	N/A	S	S	S
DDC / Energy Management Features						
Echelon LonMark Compliant	N/A	S	N/A	N/A	S	N/A
BACNET Compliant	N/A	N/A	S	N/A	N/A	S
Johnson N2 Compliant	N/A	N/A	S	N/A	N/A	S
Modbus Compliant	N/A	N/A	S	N/A	N/A	S
Leaving Air and Water Temperature Sensor	N/A	S	S	N/A	S	S
Digital Wall Sensor	N/A	O	O	N/A	O	O

S = Standard O = Optional DDC = Feature can be provided by DDC System CXM-Lon = CXM with LonMark Module
DXM-Lon = DXM with LonMark Module CXM-MPC = CXM with MPC Module DXM-MPC = DXM with MPC Module
* = Check with your Factory Representative for model availability MPC = Multiple ProtoCol (BACNET, N2, Modbus)

TRM Vertical Stack Series 60Hz
Engineering Guide Specs. Rev.: 07/07/06

General:
Furnish and install ClimateMaster Water Source Heat Pumps, as indicated on the plans with capacities and characteristics as listed in the schedule and the specifications that follow.

Vertical Stack Water Source Heat Pumps:
Units shall be low range, 20° to 120°F (-6.7° to 48.9°C) entering water temperature for low temperature application. Equivalent units from other manufacturers can be proposed provided approval to bid is given 10 days prior to bid closing. All equipment listed in this section must be rated and certified in accordance with American Refrigeration Institute / International Standards Organization (ARI / ISO) and Canadian Standards Association (CSA-US). The units shall have ARI / ISO and CSA-US labels. All cabinets shall be factory tested under normal operating conditions, risers shall be pressure tested and chassis shall be factory tested under normal operating conditions and water flow rates. ***Units tested without water flow are not acceptable.***

Basic Construction:
The cabinet panels shall be fabricated from heavy gauge galvanized steel. The rigid one-piece cabinet shall be constructed so that it is self-supporting, and can be installed long before the chassis arrival, and to be able to avoid damage during construction. Top, base, fan deck, and other metal structural parts are to be 16 gauge construction, while exterior panels to be 20 gauge; unit further strengthened by structural breaks at corners. ***Units not constructed of a minimum of these thicknesses are not acceptable.*** Cabinet shall have a top panel and a bottom panel for structural rigidity of the cabinet; ***no "open" top or "open" bottom designs allowed.***

The cabinet base shall contain a secondary drain pan fully insulated with a pressure differential drain trap connected to the condensate riser pipe, and guide rails for the slide in refrigeration chassis. Drain pan(s) shall be easily accessible for cleaning. All interior surfaces shall be lined with 1/2 inch (12.7mm) thick, dual density 1-3/4 lb/ft3 (28 kg/m3) acoustic type fiberglass insulation. All fiberglass shall be coated and have exposed edges butted up to flanges to prevent the introduction of glass fibers into the air stream.

Standard cabinet panel insulation must meet NFPA 90A requirements, air erosion and mold growth limits of UL-181, stringent fungal resistance test per ASTM-C1071 and ASTM G21, and shall meet zero level bacteria growth per ASTM G22. ***Unit insulation must meet these stringent requirements or unit(s) will not be accepted.***

Cabinet arrangements shall allow symmetrical placement of riser piping on any of the three sides of the cabinet not used for the chassis access. All Cabinet openings shall have dry wall flanges on all sides. Supply air openings shall be factory cut and flanged as shown on plans. For air noise attenuation purposes, the discharge air from fan shall discharge into insulated plenum that also contains insulated air baffles at all cabinet supply air openings. ***Units not having supply air noise baffles are not acceptable.*** Cabinet design shall allow a full height base board (5 inches/127mm) beneath the chassis access. The cabinet shall contain an easily removable motor/blower assembly.

Full length supply, return, and insulated condensate water risers shall be type M copper with integral internal piping including ball valves (for shut off purposes at unit). Field installed hose kits are required to connect the chassis piping to the cabinet piping. The condensate riser shall be insulated with 3/8" (9.5mm) Armaflex type insulation. The top of each riser shall be deeply swaged (3 in./76.2mm) to accept connection to the riser above/below, allowing for a floor to floor dimensional variance of ± one inch (25.4mm). Units not having swaged riser-piping connections shall not be acceptable. ***Couplings and trim pieces shall not be allowed.***

Option: Type L riser piping.

Option: Unit mounted Thermostat provisions -- includes insulated junction box mounted inside discharge plenum that is connected to Molex-type connector wired to unit thermostat terminals, and having tile ring on cabinet for drywall installation to accept thermostat mounting. Use part number A9155724, A9155728 or A9155729 thermostat assembly, which is thermostat model ATM11C01, ATM11C03 or ATA11C04, respectively with mating Molex-type connector.

Fan and Motor Assembly:
The cabinet shall contain a removable motor/blower assembly. Units shall have a direct drive centrifugal fan. The fan motor

shall be 2 speed, permanently lubricated, PSC type with thermal overload protection. The fan motor shall be isolated from the fan housing by a torsionally flexible motor mounting system with rubber type grommets to inhibit vibration induced high noise levels associated with "hard wire belly band" motor mounting. Airflow/External static pressure rating of the unit shall be based on a wet coil and clean filter.

Chassis:
The chassis, which incorporates the air coil, water coil, drain pan, and compressor, shall be easily installed for quick jobsite installation and future servicing purposes. The slide in chassis shall have an insulated panel separating the fan compartment from the compressor compartment. Compressors are not in the air stream. The chassis base shall be fabricated from heavy gauge galvanized steel formed to match the slide in rails of the cabinet. All electrical connections between the chassis and cabinet shall be made via locking quick-connects. Units shall have a factory installed 1 inch (25.4mm) thick filter bracket and throwaway type glass fiber filter. Furnish one spare set of filters.

Water connections between chassis and the cabinet shall be accomplished via a hose kit consisting of Kevlar-reinforced EPDM core hose surrounded by a stainless-steel braid. Hose kit shall have brass fittings with stainless-steel ferrules. Hose ends shall be solid External NPT which connects to mating fitting on cabinet shut off ball valve(s), and Internal NPSM (National Pipe Straight Mechanical) swivel end with fiber or EPDM washer which connects to mating threaded end connection on chassis. The hose kit shall be rated for 350 psi (2412 kPa) design working pressure.

Refrigerant Circuit:
All units shall contain an EarthPure® (HFC 410A) sealed refrigerant circuit including a high efficiency scroll or rotary compressor designed for heat pump operation, a thermostatic expansion valve for refrigerant metering, an enhanced corrugated aluminum lanced fin and rifled copper tube refrigerant to air heat exchanger, reversing valve, coaxial (tube in tube) refrigerant to water heat exchanger, and safety controls including a high pressure switch, low pressure switch (loss of charge), water coil low temperature sensor, and air coil low temperature sensor. Access fittings shall be factory installed on high and low pressure refrigerant lines to facilitate field service. Activation of any safety device shall prevent compressor operation via a microprocessor lockout circuit. The lockout circuit shall be reset at the thermostat or at the contractor supplied disconnect switch. ***Units that cannot be reset at the thermostat shall not be acceptable.***

Hermetic compressors shall be internally sprung and externally isolated. The compressor shall have a dual level vibration isolation system. The compressor will be mounted on rubber grommets to a large heavy gauge compressor mounting tray plate, which is then isolated from the cabinet base with vibration isolation springs for maximized vibration attenuation. All units (except units with rotary compressors) shall include a discharge muffler to further enhance sound attenuation. Compressor shall have thermal overload protection. Refrigerant to air heat exchangers shall utilize enhanced corrugated lanced aluminum fins and rifled copper tube construction rated to withstand 625 PSIG (3101 kPa) refrigerant working pressure. Refrigerant to water heat exchangers shall be of copper inner water tube and steel refrigerant outer tube design, rated to withstand 625 PSIG (3101 kPa) working refrigerant pressure and 500 PSIG (3101 kPa) working water pressure.

Refrigerant metering shall be accomplished by thermostatic expansion valve only. Expansion valves shall be dual port balanced types with external equalizer for optimum refrigerant metering. Reversing valve shall be four-way solenoid activated refrigerant valve, which shall default to heating mode should the solenoid fail to function. If the reversing valve solenoid defaults to cooling mode, an additional low temperature thermostat must be provided to prevent over-cooling an already cold room.

Option: The refrigerant to air heat exchanger shall be "electro-coated" with a low cure cathodic epoxy material a minimum of 0.4 mils thick (0.4 – 1.5 mils range) on all surfaces. The black colored coating shall provide a minimum of 1000 hours salt spray protection per ASTM B117-97 on all galvanized end plates and copper tubing, and a minimum of 2000 hours of salt spray on all aluminum fins. The material shall be formulated without the inclusion of any heavy metals and shall exhibit a pencil hardness of 2H (ASTM D3363-92A), crosshatch adhesion of 4B-5B (ASTM D3359-95), and impact resistance of 160 in/lbs direct (ASTM D2794-93).

Option: The unit will be supplied with cupro nickel coaxial water to refrigerant heat exchanger.

Option: The unit will be supplied with internally factory mounted two-way water valve for variable speed pumping requirements. A factory-mounted or field-installed high pressure switch shall be installed in the water piping to disable compressor operation in the event water pressures build due to water freezing in the piping system.

Option: The unit will be supplied with internally factory mounted automatic water flow regulators.

Option: The unit will be supplied with internally mounted secondary pump for primary/secondary applications.

Cabinet Drain Pan:
The drain pan shall be constructed of galvanized steel and have a powder coat paint application to further inhibit corrosion. This corrosion protection system shall meet the stringent 1000 hour salt spray test per ASTM B117. If plastic type material is used, it must be HDPE (High Density Polyethylene) to avoid thermal cycling shock stress failure over the lifetime of the unit. Stainless Steel materials are also acceptable. Drain pan shall be fully insulated. Drain pan shall have at a minimum a doubled sloped surface to allow positive drainage to the outlet opening, which shall be at the lowest level of the entire pan suface. Drain outlet shall be connected from pan outlet to condensate riser (if supplied) with factory installed trap inside of cabinet. The unit as standard will be supplied with solid-state electronic condensate overflow protection. ***Mechanical float switches will NOT be accepted.***

Electrical:
A control box shall be located within the unit compressor compartment and shall contain a 50VA transformer, 24 volt activated, 2 or 3 pole compressor contactor, terminal block for thermostat wiring and solid-state controller for complete unit operation. Reversing valve and fan motor wiring shall be routed through this electronic controller. Units shall be name-plated for use with time delay fuses or HACR circuit breakers. Unit controls shall be 24 Volt and provide heating or cooling as required by the remote thermostat / sensor.

Option: Disconnect Switch, Non-Fused

Option: Circuit Breaker

Solid State Control System (CXM):
Units shall have a solid-state control system. ***Units utilizing electro-mechanical control shall not be acceptable.*** The control system microprocessor board shall be specifically designed to protect against building electrical system noise contamination, EMI, and RFI interference. The control system shall interface with a heat pump type thermostat. The control system shall have the following features:

a. Anti-short cycle time delay on compressor operation.
b. Random start on power up mode.
c. Low voltage protection.
d. High voltage protection.
e. Unit shutdown on high or low refrigerant pressures.
f. Unit shutdown on low water temperature.
g. Condensate overflow electronic protection.
h. Option to reset unit at thermostat or disconnect.
i. Automatic intelligent reset. Unit shall automatically reset the unit 5 minutes after trip if the fault has cleared. If a fault occurs 3 times sequentially without thermostat meeting temperature, then lockout requiring manual reset will occur.
j. Ability to defeat time delays for servicing.
k. Light emitting diode (LED) on circuit board to indicate high pressure, low pressure, low voltage, high voltage, low water/air temperature cut-out, condensate overflow, and control voltage status.
l. The low-pressure switch shall not be monitored for the first 120 seconds after a compressor start command to prevent nuisance safety trips.
m. 24V output to cycle a motorized water valve or other device with compressor contactor.
n. Unit Performance Sentinel (UPS). The UPS warns when the heat pump is running inefficiently.
o. Water coil low temperature sensing (selectable for water or anti-freeze).
p. Air coil low temperature sensing.

NOTE: Units not providing the 8 safety protections of anti-short cycle, low voltage, high voltage, high refrigerant pressure, low pressure (loss of charge), air coil low temperature cut-out, water coil low temperature cut-out, and condensate overflow protections will not be accepted.

Option: Enhanced solid state control system (DXM)
This control system features two stage control of cooling and two stage control of heating modes for exacting temperature and dehumidification purposes.

This control system coupled with a multi-stage thermostat will better dehumidify room air by automatically running the heat pump's fan at lower speed on the first stage of cooling thereby implementing low sensible heat ratio cooling. On the need for higher cooling performance the system will activate the second stage of cooling and automatically switch the fan to the higher fan speed setting. This system may be further enhanced with a humidistat. ***Units not having automatic low sensible heat ratio cooling will not be accepted;*** as an alternate a hot gas reheat coil may be provided with control system for automatic activation.

Control shall have all of the above mentioned features of the CXM control system along with the following expanded features:

a. Removable thermostat connector.
b. Night setback control.
c. Random start on return from night setback.
d. Minimized reversing valve operation (Unit control logic shall only switch the reversing valve when cooling is demanded for the first time. The reversing valve shall be held in this position until the first call for heating, ensuring quiet operation and increased valve life.).
e. Override temperature control with 2-hour (adjustable) timer for room occupant to override setback temperature at the thermostat.
f. Dry contact night setback output for digital night setback thermostats.
g. Ability to work with heat pump or heat/cool (Y, W) type thermostats.
h. Ability to work with heat pump thermostats using O or B reversing valve control.
i. Emergency shutdown contacts.
j. Boilerless system heat control at low loop water temperature.
k. Ability to allow up to 3 units to be controlled by one thermostat.
l. Relay to operate an external damper.
m. Ability to automatically change fan speed from multistage thermostat.
n. Relay to start system pump.
o. 75 VA control transformer. Control transformer shall have load side short circuit and overload protection via a built in circuit breaker.

Remote Service Sentinel (CXM/DXM):
Solid state control system shall communicate with thermostat to display (at the thermostat) the unit status, fault status, and specific fault condition, as well as retrieve previously stored fault that caused unit shutdown. The Remote Service Sentinel allows building maintenance personnel or service personnel to diagnose unit from the wall thermostat. The control board shall provide a signal to the thermostat fault light, indicating a lockout. Upon cycling the G (fan) input 3 times within a 60 second time period, the fault light shall display the specific code as indicated by a sequence of flashes. A detailed flashing code shall be provided at the thermostat LED to display unit status and specific fault status such as over/under voltage fault, high pressure fault, low pressure fault, low water temperature fault, condensate overflow fault, etc. ***Units that do not provide this remote service sentinel shall not be acceptable.***

Option: Lonworks interface system
Units shall have all the features listed above (either CXM or DXM) and the control board will be supplied with a LONWORKS interface board, which is LONMark certified. This will permit all units to be daisy chained via a 2-wire twisted pair shielded cable. The following points must be available at a central or remote computer location:
a. Space temperature
b. Leaving water temperature
c. Discharge air temperature
d. Command of space temperature setpoint
e. Cooling status
f. Heating status
g. Low temperature sensor alarm
h. Low pressure sensor alarm
i. High pressure switch alarm

j. Condensate sensor alarm
k. Hi/low voltage alarm
l. Fan "ON/AUTO" position of space thermostat as specified above
m. Unoccupied / occupied command
n. Cooling command
o. Heating command
p. Fan "ON / AUTO" command
q. Fault reset command
r. Itemized fault code revealing reason for specific shutdown fault (any one of 7)

This option also provides the upgraded 75VA control transformer with load side short circuit and overload protection via a built in circuit breaker.

Option: MPC (Multiple Protocol Control) interface system
Units shall have all the features listed above (either CXM or DXM) and the control board will be supplied with a Multiple Protocol interface board. Available protocols are BACnet MS/TP, Modbus, or Johnson Controls N2. The choice of protocol shall be field selectable/changeable via the use of a simple selector switch. Protocol selection shall not require any additional programming or special external hardware or software tools. This will permit all units to be daisy chain connected by a 2-wire twisted pair shielded cable. The following points must be available at a central or remote computer location:
a. Space temperature
b. Leaving water temperature
c. Discharge air temperature
d. Command of space temperature setpoint
e. Cooling status
f. Heating status
g. Low temperature sensor alarm
h. Low pressure sensor alarm
i. High pressure switch alarm
j. Condensate overflow alarm
k. Hi/low voltage alarm
l. Fan "ON/AUTO" position of space thermostat as specified above
m. Unoccupied / occupied command
n. Cooling command
o. Heating command
p. Fan "ON / AUTO" command
q. Fault reset command
r. Itemized fault code revealing reason for specific shutdown fault (any one of 7)

This option also provides the upgraded 75VA control transformer with load side short circuit and overload protection via a built in circuit breaker.

Return Panel / Supply Grilles:
The return panel shall be architecturally designed, acoustic type, flush mounted with hinged door for easy and quick access to filter and unit interior. Chassis shall be easily removed. The hinged return panel shall be made of heavy gauge die formed galvanized steel with a powder coat finish in "polar ice" color. ***Return air panels that protrude from wall more than 5/8 inch (15.9mm) are not acceptable.*** Supply grille(s) shall be architecturally designed "brushed" aluminum or powder coated steel (color: polar ice).

Option: supply grille with Double deflection damper style louvers.

Option: Style "H" Return air panel that allows outside air entry just behind panel on right or left side (Note: This option eliminates unit-mounted thermostat option).

Warranty:
ClimateMaster shall warranty equipment for a period of 12 months from start up or 18 months from shipping (which ever occurs first).

Option: Extended 4-year compressor warranty covers compressor for a total of 5 years.

Option: Extended 4-year refrigeration circuit warranty covers coils, reversing valve, expansion valve and compressor for a total of 5 years.

Option: Extended 4-year control board warranty covers the CXM/DXM control board for a total of 5 years.

FIELD INSTALLED OPTIONS

Hose Kits - AHH Series (required for field water connections):
Water connections between chassis and the cabinet shall be accomplished via a hose kit consisting of Kevlar-reinforced EPDM core hose surrounded by a stainless-steel braid. Hose kit shall have brass fittings with stainless-steel ferrules. Hose ends shall be solid External NPT which connects to mating fitting on cabinet shut off ball valve(s), and Internal NPSM (National Pipe Straight Mechanical) swivel end with fiber or EPDM washer which connects to mating threaded end connection on chassis. The hose kit shall be rated for 350 psi (2412 kPa) design working pressure. This hose kit accessory is required for each cabinet.

Thermostats:
The thermostat shall be a ClimateMaster mechanical or electronic type thermostat as selected below with the described features:

a. Single Stage Standard Manual Changeover (ATM11C01)
Thermostat shall be a single-stage, vertical mount, manual changeover with HEAT-OFF-COOL system switch and fan ON-AUTO switch. Thermostat shall have a mechanical temperature indicator and set point indication. Thermostat shall only require 4 wires for connection. ***Mercury bulb thermostats are not acceptable.***

b. Single Stage Digital Manual Changeover with Two-Speed Fan Control (ATM11C03) – DXM and PSC Fan required
Thermostat shall be a single-stage, digital, manual changeover with HEAT-OFF-COOL system switch, fan ON-AUTO switch, and fan LO-HI switch. Thermostat shall have an LCD display with temperature and set-point(s) in °F or °C. The Thermostat shall provide permanent memory of set-point(s) without batteries. A fault LED shall be provided to display specific fault condition. Thermostat shall come standard with remote temperature sensor, but may be operated with internal sensor if desired via installation of a jumper.

c. Single Stage Digital Auto or Manual Changeover (ATA11U01)
Thermostat shall be a single-stage, digital, auto or manual changeover with HEAT-OFF-COOL-AUTO system switch and fan ON-AUTO switch. Thermostat shall have an LCD display with temperature and set-point(s) in °F or °C. The Thermostat shall provide permanent memory of set-point(s) without batteries. A fault LED shall be provided to display specific fault condition. Thermostat shall provide temperature display offset for custom applications.

d. Single Stage Digital Automatic Changeover with Two-Speed Fan Control (ATA11C04) – DXM and PSC Fan required
Thermostat shall be a single-stage, digital, auto or manual changeover with HEAT-OFF-COOL-AUTO system switch, fan ON-AUTO switch, and fan LO-HI switch. Thermostat shall have an LCD display with temperature and set-point(s) in °F or °C. The Thermostat shall provide permanent memory of set-point(s) without batteries. A fault LED shall be provided to display specific fault condition. Thermostat shall come standard with remote temperature sensor, but may be operated with internal sensor if desired via installation of a jumper.

e. Multistage Digital Automatic Changeover (ATA22U01)
Thermostat shall be multi-stage (2H/2C), manual or automatic changeover with HEAT-OFF-COOL-AUTO system settings and fan ON-AUTO settings. Thermostat shall have an LCD display with temperature, set-point(s), mode, and status indication. The temperature indication shall be selectable for °F or °C. The thermostat shall provide permanent memory of set-point(s) without batteries. A fault LED shall be provided to indicate specific fault condition(s). Thermostat shall provide temperature display offset for custom applications. Thermostat shall allow unit to provide better dehumidification with optional DXM controller by automatically using lower fan speed on stage 1 cooling (higher latent cooling) as main cooling mode, and automatically shifting to high speed fan on stage 2 cooling.

f. Single Stage Manual Changeover Programmable 5/2 Day (ATP11N01)
Thermostat shall be 5 day/2 day programmable (with up to 4 set points per day), single stage (1H/1C), manual changeover with HEAT-OFF-COOL system settings and fan ON-AUTO settings. Thermostat shall have an LCD display with temperature, set-point(s), mode, and status indication. The temperature indication shall be selectable for °F or °C. The thermostat shall provide permanent memory of set-point(s) without batteries. Thermostat shall provide convenient override feature to temporarily change set point.

g. Multistage Automatic or Manual Changeover Programmable 5/2 Day (ATP21U01)
Thermostat shall be 5 day/2 day programmable (with up to 4 set points per day), multi-stage (2H/1C), automatic or manual

changeover with HEAT-OFF-COOL-AUTO system settings and fan ON-AUTO settings. Thermostat shall have an LCD display with temperature, set-point(s), mode, and status indication. The temperature indication shall be selectable for °F or °C. The thermostat shall provide permanent memory of set-point(s) without batteries. Thermostat shall provide convenient override feature to temporarily change set point.

h. Multistage Automatic or Manual Changeover Programmable 7 Day (ATP32U01)
Thermostat shall be 7 day programmable (with up to 4 set points per day), multi-stage (3H/2C), automatic or manual changeover with HEAT-OFF-COOL-AUTO system settings and fan ON-AUTO settings. Thermostat shall have a blue backlit dot matrix LCD display with temperature, set-points, mode, and status indication. The temperature indication shall be selectable for °F or °C. Time display shall be selectable for 12 or 24 hour clock. Fault identification shall be provided (when used with ClimateMaster CXM or DXM controls) to simplify troubleshooting by providing specific unit fault at the thermostat with red backlit LCD during unit lockout. The thermostat shall provide permanent memory of set-points without batteries. Thermostat shall provide heating set-point range limit, cooling set-point range limit, temperature display offset, keypad lockout, dead-band range setting, and inter-stage differential settings. Thermostat shall provide progressive recovery to anticipate time required to bring space temperature to the next programmed event. Thermostat shall provide an installer setup for configuring options and for setup of servicing contractor name and contact information. Thermostat shall allow the use of an accessory remote and/or outdoor temperature sensor (AST008). Thermostat navigation shall be accomplished via five buttons (up/down/right/left/select) with menu-driven selections for ease of use and programming.

i. Multistage Automatic or Manual Changeover Programmable 7 Day with Humidity Control (ATP32U02)
Thermostat shall be 7 day programmable (with up to 4 set points per day), multi-stage (3H/2C), automatic or manual changeover with HEAT-OFF-COOL-AUTO system settings and fan ON-AUTO settings. Separate dehumidification and humidification set points shall be configurable for discreet outputs to a dehumidification option and/or an external humidifier. Installer configuration mode shall allow thermostat dehumidification mode to operate with ClimaDry reheat or with ECM fan dehumidification mode via settings changes. Thermostat shall have a blue backlit dot matrix LCD display with temperature, relative humidity, set-points, mode, and status indication. The temperature indication shall be selectable for °F or °C. Time display shall be selectable for 12 or 24 hour clock. Fault identification shall be provided (when used with ClimateMaster CXM or DXM controls) to simplify troubleshooting by providing specific unit fault at the thermostat with red backlit LCD during unit lockout. The thermostat shall provide permanent memory of set-points without batteries. Thermostat shall provide heating set-point range limit, cooling set-point range limit, temperature display offset, keypad lockout, dead-band range setting, and inter-stage differential settings. Thermostat shall provide progressive recovery to anticipate time required to bring space temperature to the next programmed event. Thermostat shall provide an installer setup for configuring options and for setup of servicing contractor name and contact information. Thermostat shall allow the use of an accessory remote and/or outdoor temperature sensor (AST008). Thermostat navigation shall be accomplished via five buttons (up/down/right/left/select) with menu-driven selections for ease of use and programming.

DDC Sensors:
ClimateMaster wall mounted DDC sensor to monitor room temperature and interfaces with optional interface system described above. Several types as described below:

a. Sensor only with no display (LON and MPC).
b. Sensor with override (LON only).
c. Sensor with setpoint and adjustment override (MPC only).
d. Sensor with setpoint and adjustment override, LCD display, status/fault indication (LON and MPC).

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